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Studies of Identical Twins Reared Apart

By

BARBARA S. BURKS AND ANNE ROE

With Foreword and Introduction by
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BARBARA S. BURKS

FOREWORD

THE TRAGIC death of Barbara Stoddard Burks on May 25, 1943, at the early age of 40 years, was a truly serious loss not only to psychology but also to biology, sociology, and education. Her record for creative productivity, which has rarely been equalled by one of her years either in quantity or quality, was made possible by an extraordinary combination of intellect, energy, and scientific enthusiasm.

Barbara graduated from Stanford in 1924 with Phi Beta Kappa honors and "with great distinction." She was my research assistant from 1924 to 1929 and my research associate in 1929-30. Her Ph.D. dissertation was completed in 1927, but because of her extensive collaboration with me on other research and writing she did not receive her degree until 1929. Her later academic career was as follows: school psychologist in Pasadena, 1931-32; research associate in child welfare at the University of California, 1932-34; General Education Board Fellow, 1934-36; research associate at the Carnegie Institution, 1936-43. For two years preceding her death she was also associate in psychology at Columbia University.

Barbara's minor field of study for the doctorate was mathematics, with emphasis on statistical procedures applicable to bio-social problems. As a graduate student she also found time to master, as few psychologists ever do, the fundamental principles of genetics. Her interests were primarily oriented toward the nature and nurture factors that determine human development, rather than toward any one discipline as such; she was willing to equip herself in whatever border-zone fields would contribute to this end.

The early flowering of Barbara's genius

is indicated by the fact that she had planned the main outlines of her life work on nature and nurture by the age of 20 years and had completed her famous study of California foster children soon after her 24th birthday, notwithstanding the extensive assistance she was giving me at the time in a follow-up of my gifted-group and in the preparation of the 1928 *Yearbook* of the National Society for the Study of Education. Nor is it any disparagement of her later work to say that this study deserves to be ranked among the best of her entire career, indeed among the dozen or so most important contributions in the history of nature-nurture research from Galton to the present.

Although Barbara's later researches covered a wide range of topics, the nature-nurture problem remained her strongest interest. For some time before her death she had been engaged in a second study of foster children in the state of New York. This research was financed by the Carnegie Corporation and was being carried out under the auspices of the Social Science Research Council. While engaged in this study she discovered several pairs of identical twins who had been reared apart, and only a month before her death she was awarded a Guggenheim Fellowship to enable her to complete her study of these and such other pairs of separated identical twins as she might be able to locate.

Prior to the award of this fellowship Barbara had published a detailed analysis of the personality characteristics of one identical-twin pair. This analysis was a masterpiece of finesse in ferreting out minor as well as major differences in personality and in behavior and it indicates the type of work she planned to do with

ten or a dozen other pairs during the term of her Guggenheim Fellowship. Before her death she had collected a considerable amount of data on four additional pairs and it is this material which has been brought together and summarized by Dr. Anne Roe in the present monograph.

The monograph has been prepared under the auspices of a Committee on the Barbara Burks Memorial Fund, to which contributions were made by 62 friends of Barbara's or organizations of which she was a member. Ruth S. Tolman was chairman of the committee and its other members were Gordon Allport, Katherine Brehme, Robert Cook, Kurt Lewin, Theodore Newcomb, Lewis M. Terman, and Robert S. Woodworth.

The material left by Barbara consisted almost entirely of raw data and notes which were in several respects incomplete and sometimes difficult to decipher. Needless to say, the summarizing of another's material is inevitably a difficult task, and the sponsoring committee feels greatly indebted to Dr. Roe for her willingness to take time out from her own researches to salvage what could be salvaged of the data Barbara had collected.

Dr. Roe was the unanimous choice of the committee for the undertaking both because of her professional competence and because she had worked for a time with Barbara and was familiar with the project. Barbara's sister, Frances Burks Newman, who worked with her in the study of some of the twin pairs, has reviewed the manuscript and enriched it appreciably by many valuable suggestions. The monograph owes much to the editorial work of Dr. Tolman, chairman of the sponsoring committee.

In view of the incompleteness of the record at the time of Barbara's death, it was not to be expected that this summary and interpretation could be anything like as conclusive as one would wish. Dr. Roe has made the most of the material that was available, but the outcome is far short of what Barbara would have accomplished if she had lived to complete the study. Nevertheless, because of the great scarcity of scientific data on identical twins reared apart, it has seemed to our committee desirable to make the records available to other workers in this important field of research.

LEWIS M. TERMAN

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CHAPTER I

INTRODUCTION

LEWIS M. TERMAN

NEARLY three-quarters of a century have passed since Galton (4) initiated the scientific study of twins as a method of assessing the relative contributions of nature and nurture to human development. The influence of this pioneer study is attested by the hundreds of twin researches that have been published, in many languages, since Galton's tentative conclusions were first made known. The great majority of these researches have dealt with the relative degree of similarity in monozygotic and dizygotic twins. The results of such studies, if taken at their face value, indicate that twins of monozygotic origin are far more alike not only in physique, but also in their abilities and temperament, than are dizygotics. The precise significance of this finding for nature-nurture theory has been questioned, however, on the ground that environment is likely to be more nearly the same for identical than for fraternal twins, and on the ground that it is difficult to establish with certainty the zygosity of a twin pair.

The first of these problems can be met by the study of identical twins reared apart. If two such twins are separated in early childhood and are subjected to unlike physical and mental environments, then in all probability marked differences between them in later years would have to be accredited to the differing environments in which they were placed. We have to say "in all probability," rather than "certainly," because of two other possibilities: (1) it is possible for one twin of an identical pair to suffer a birth injury which the other

escapes; (2) it sometimes happens that the two embryos from a single egg are unequally nourished or that the normal development of one is interfered with by its position in utero with relation to the other (12, 13). It is not always easy to rule out the developmental influence of these factors.

More serious is the problem of establishing zygosity. Many of the early investigators, including Galton, assumed that if twins resemble one another so closely as to be hardly distinguishable in general appearance they must be identicals. Usually they are, but the converse of this rule does not hold. That is, there are identical twins sufficiently unlike physically that they are easily distinguished from each other but whose one-egg origin can be established with practical certainty by the combined evidence from various kinds of physical data, including fingerprints, pigmentation, dental occlusion, hair diameter, hair distribution, cephalic index, and mirror-image effects. Close resemblances in height, weight, and similar physical measurements have some value as corroborative evidence but are never crucial when considered alone. Mirror-imaging in hair whorl, palm patterns, dentition, or handedness is strong evidence of monozygosity, but its absence is no proof of dizygosity. It was formerly believed that certain diagnosis was possible by examination of the fetal membranes, but it is now known that this method is by no means infallible (7, 10, 14). Whether identical twins have separate chorions or separate placentae may depend upon

how early the cleavage occurs in embryonic development (11, p. 34).

When diagnoses are made by practiced experts using all the accepted lines of physical evidence, zygosity can be determined with a high degree of certainty in something like 97 or 98 per cent of twin pairs (2). The less practiced observer, of course, is more likely to make a wrong classification. The twins Johnny and Jimmy, selected by McGraw (8) as identicals and subjected by her to a long course of differential physical training, were widely publicized as proof of the potency of environmental factors. Later, however, it was established that these twins were not identicals but fraternal. The data on which a diagnosis of zygosity has been made always call for most careful scrutiny.

There is another circumstance which makes the study of identical twins reared apart less crucial than one could wish. Even if the monozygosity of the twin pairs has been satisfactorily established, and if the effects of birth injury and inequalities of prenatal environment have also been ruled out, the resemblance shown by a given separated pair might be due to the similarity of their environments. The ideal experiment would be to separate a large number of identical pairs in early infancy and to rear the two members of each pair in *radically different* environments. Because of the practical difficulties of carrying out a controlled experiment of this kind, it is necessary to locate identical twins who for one reason or another have been separated in early life and kept apart. Unfortunately, the number of such cases is extremely small in this country. The ten-year study by Newman, Freeman, and Holzinger (11) brought to light only 19 pairs. Perhaps this number would have yielded fairly conclusive results if the two

members of every pair had been subjected to widely differing environments. This was true, however, for only four or five pairs out of the 19. Apart from these few cases, resemblance between the identical twins reared apart was about as close as the authors had found for 50 pairs of identical twins reared together. It thus appears that environmental differences have to be fairly large to produce much effect upon trait differences, though the amount of effect varies from trait to trait, being greater for school achievement and personality traits than for physical traits (11).

Another approach to the problem is by the method of co-twin control in learning experiments. This involves the selection of young identical-twin pairs, the subjection of one twin to a period of intensive training which the other is not given, and later follow-up to check the permanency of training effects. The method was first suggested by Gesell and has been used by him and his co-workers in a number of interesting studies to test the permanency of training in such activities as talking, stair climbing, and other motor skills (5, 6, 15). The ill-fated experiment by McGraw, previously mentioned, was an attempt to apply this technique to training in athletic stunts. Theoretically, the method has great possibilities; the chief limitation to its usefulness is the practical difficulty of arranging for long periods of training during which the untrained twin must be deprived of opportunity to benefit from the training given the other. Because of this difficulty, the training periods have usually been relatively brief and the training-effects quite ephemeral. How permanent the effects would be with longer and more intensive training remains to be determined.

It is clear, even from this all too brief

discussion, that data on separated twins are often difficult to interpret and that they provide a less definitive test of nature and nurture influences than some investigators have expected (9). Nevertheless, the method is important. Especially valuable are such highly detailed qualitative comparisons as those made by Dr. Burks on a single pair (1). If similarly detailed studies could be made of 20 or 30 pairs the results might be more significant than the usual kinds of measurements applied to a much larger population.

The following case reports, of four pairs of identical twins who were reared apart, are summaries and analyses of data collected by Barbara Burks and found in her files after her death. There are often cryptic notations which were obviously intended to remind her of incidents or opinions which she would have remembered in analyzing the data. The impossibility of deciphering these and lack of personal acquaintance with any of the subjects necessarily rob this published

record of that warm, personal touch which Barbara Burks was so richly able to give the raw clinical data, and make judgment of many points of clinical interest impracticable. The aim has been therefore only to arrange and organize the data so that they will be available for other investigators in this field. Everything which was definite in the records has been included.

An attempt has been made as far as the data permit to follow the plan used by Dr. Burks in her study of the first pair of twins, Adelaide and Beatrice. The names used are fictitious and have been assigned in accordance with the scheme used in the report of A and B, so that the initials of the names follow alphabetically.¹

Further study might profitably be made of Adelaide and Beatrice, of Clara and Doris, of Earl and Frank, and of James and Keith. The other pair cannot be studied again because Helen, one of the members of the pair, died shortly after Dr. Burks' interviews were made.

¹ See Reference 1.

CHAPTER II

TWINS CLARA AND DORIS

THE TWIN girls Clara and Doris were born in 1902, among the youngest of 14 children, including three sets of twins. Five were living at the time of the study, the rest having died either at the orphanage in which most of them were placed, or at other institutions. In a summary of the family history in the neuropsychiatric hospital record of Doris, it is stated: "Our patient is one of 14 children and in this sibling generation are numerous instances of unstable, peculiar, maladjusted individuals."

Their own father is reported to have been an illiterate logger of German descent, heavily alcoholic, and a promiscuous rover. He was a Methodist in religion. Their own mother was English and is reputed to have been a dancer. It seems apparent that all of the children were neglected; it is said that these twins were left in a buggy all day while their mother took in washing. (In such a case, she must have been making some attempt to look after her family.) Doris says that the State removed the children from their own parents on the complaints of the neighbors, but Clara's story is that the mother, becoming discouraged when the father left, burned down the house, and put the children in an institution because she could not support them.

In any case, they did not remain long with their own parents, but were placed in an orphanage before they were two years old. Shortly afterward Clara was taken from the orphanage by foster parents, who adopted her the following year. Doris was adopted a year later by the family with whom she lived during her second placement. When they were about 30, the two sisters saw each other

for the first time since infancy, and they kept in close touch with each other from that time on.

EVIDENCE FOR MONOZYGOTIC ORIGIN OF THE TWINS

Comparison of Clara and Doris with respect to a selection of physical traits in standard use as criteria for one-egg origin of twins indicates that they are monozygotic. They appear to be at least as similar on these traits as did the twins Adelaide and Beatrice, whose "classification as monozygotic seemed well established" by Dr. Burks' analysis.² The evidence is summarized in Table 1.

ENVIRONMENTAL SURROUNDINGS AND HISTORY

Community. Clara was brought up in an urban community of moderate size, but Doris, after a few years in smaller communities, was taken to a large Eastern city where she grew up.

The foster homes. Clara was brought up as an only child. Her foster father had a notion store, with residence on the floor above. When Clara was about 11, he became a minor county official. He liked building things and Clara spent much time with him, sharing his work at home. Her foster mother was a little older than the father, a little melancholy, and her chief interest was her garden. She also sewed and cooked skillfully but let Clara help her in the kitchen only on special occasions. Clara "used to watch her," though, and "picked up things," so that when her mother went to work in a laundry when Clara was 13 or 14, the

² See Reference 1, p. 41.

TABLE I
PHYSICAL CRITERIA OF ZYGOTIC ORIGIN
TWINS CLARA AND DORIS

Age 39 Years	Twin C		Twin D	
Height (stocking feet)	156.6 cm.		154.4 cm.	
Head breadth	15.2 cm.		14.9 cm.	
Head length	17.9 cm.		18.1 cm.	
Cephalic index	85		83	
	Sudden declivity in skull from same point			
Interpupillary distance	6.2 cm.		5.9 cm. (approx.)	
Eye color (Martin chart)	3		3	
Need for glasses	Yes		Yes	
Hair:				
Medullation	About 15%		About 2%	
Type	Discontinuous		Discontinuous	
Pigment granule pattern	Denser		More dispersed	
Average diameter shaft	75 microns		75 microns	
Cortical fusi	Numerous		Numerous	
Cuticular scales	Alike			
Skin (freckles)	None		None	
Oral cavity:				
Tongue furrows	None		None	
Form of ear	Similar shape			
Feet:				
Size of shoe	6 to 7		5 to 6	
Shape	Toe slightly curved		Toe deformity	
Hands:				
Size	Similar			
Nails	Similar			
Mid-digital hair	None		None	
Downy hair:				
Face	Lip		Lip	
Arms	To middle of arm		To middle of arm, lighter	
Handedness	Right		Right and left; can use left to sew	
Fingerprints	R		L	
Thumb	L ^u 8	L ^u 8	L ^u 15	L ^u 12
Index	A 0	A 0	L ^u 7	A
Middle	L ^u 5	A	L ^u 5	A
Ring	W 8-1	L ^u 10	L ^u 10	L ^u 11
Little	L ^u 2	L ^u 1	L ^u	A
Total ridge count	24		37	
	19		23	
Differences in ridge counts:				
bilateral, 19				
homolateral, 17				
heterolateral, 19				

girl was able to do the housework and cooking. An aunt, who usually shared a room with Clara, was also a member of the household. The family were Baptists and did very little entertaining.

Clara seems to have had a fairly happy childhood; according to her account her parents spoiled her but taught her to be polite. She had no set duties about the house, but spent much time with her foster father, helping him make fences and chicken coops. Her foster mother seems to have been somewhat compulsive about her housework, and kept Clara closely at home, permitting only her special chum to come into the house very much. Clara was never punished and her parents were generous with her. They could not understand it when she wished to leave school, but they did not "fuss at her," although her father had hoped she would learn to become a bookkeeper in his store.

Doris, the other twin, had a much less fortunate experience. Her foster parents already had two daughters and a son who later died, when they took her shortly before one of the daughters left home. Doris says that she "can't see why" they took her and she adds that they tried three times after she was adopted to get rid of her. She had very weak feet and ankles, and they thought she would always be a burden to them. The foster father was a carpenter. The family were Seventh Day Adventists, who said family prayers and observed Saturday very strictly. Doris "had to sit down on Saturday and didn't dare sneeze after Friday evening."

She was punished severely, and frequently. There was practically no entertaining at home, although Doris remembered that once church people were there and she and her foster mother's grand-

daughter were told not to open their mouths. This granddaughter had been taken into the home with Doris because her mother (D's foster sister) beat her severely, which is interesting in view of the foster mother's own generally harsh attitude. Both children worked hard around the house. Doris' only memory of any affection from her foster mother was after "things happened" and her foster father was put out of the church; it was at this time that her foster mother gave her some sex information. It is not clear whether this incident had any connection with the fact that her foster father indulged in considerable sex play with her. Doris' first child was born before her marriage, but there is no suggestion of any sexual deviation since that time.

Education. Clara got as far as fifth grade in school, but did not learn to read and write, although she did well at cooking. Her last two years in school she spent in ungraded classes. She left school finally at 12. Her family were disappointed in her school record, but did not punish her, and provided dancing and piano lessons for her.

Doris started her schooling in a one-room school when she was six. She went to school very little and hated it. She made mistakes and was often kept after school, and this usually provoked a whipping and being put to bed with nothing to eat until noon the next day. Her foster parents got a tutor for her when she was 11, but this had little effect. She said she really learned nothing at school, but picked up what little she knew from working in educated families and seeing their magazines, etc. But she did learn to write and later taught Clara to do so.

Occupational history. Clara began

work in a factory when she was 15 or 16, making \$19 a week, but left after a while because she got mad at a fellow worker. Her foster parents would have preferred to have her continue at school and made it clear that she did not have to work; but she wished to do so. At 17 she worked for a while in a hospital, washing dishes, but soon left to marry.

Doris began at 12 to look after children, and to take care of confinement cases whenever she could get the work. At 17 she worked in a sanitarium, making \$9 a week at such jobs as bottle washing. Her mother took her pay from her until she went to live at the sanitarium. Then she worked at a printing company, doing laundry, and in various other jobs. After she married, at 23, she was employed for a time in a candy factory and then again at taking care of children.

Health history. Both had measles and mumps but did not remember other childhood diseases. Both reported severe "growing pains" before their teens. Menarche for both was at 11 years. Clara reported having headaches regularly with her periods, but Doris did not have them seriously until she was about 34. Clara was later than Doris in having her tonsils removed—at 23—while Doris had lost hers at 4 or 5. Menopause began for Clara at 38; Doris had both ovaries removed at 29.

Both had suffered from hysterical loss of voice upon occasion; C only once, when tired and worried over her children's getting home, D apparently several times, since she stated that her hearing was good "except when she lost her voice." C said of her hearing that "the right side was better than the left at night." C had worn glasses since she was five because of a severe astigmatism. D said she should have had them as a

child but her mother would not get them. At the time of the study she wore them to correct farsightedness.

Both had been troubled with eczema. C always developed it from eating potatoes; D had it on her mouth as a child, and at the time of the study had had it on her fingers for some years. Both had many sties as children, but neither had had them since marriage; D had also had numerous boils.

C noted that at 23 she was hospitalized for bronchitis; and at 37 was in bed for some time with pleurisy following influenza. At 32 she had lacerations repaired and part of her uterus removed, and at 39 a nerve tumor was removed from her arm. Apart from these incidents, however, her health had been uniformly good.

D, however, suffered from many additional troubles. She underwent an operation for adhesions at 14 following a kick by a child; she contracted typhoid at 20; at 25 a cervical tumor was removed; at 29 a laparotomy was performed, and apparently her ovaries were removed; at 36 she suffered a fractured coccyx, was in the hospital for a long time, and had bladder trouble for some time following this. At 38 D had another operation to free adhesions which had caused partial intestinal obstruction. About a year later she again was admitted to a hospital with vaginal bleeding and low back pain. At this time the diagnosis was "neurotic: intestinal spasm." She had always had "nervous spells," and after her hospitalization for a broken back she was referred to the neuropsychiatric division of the hospital because of her behavior. Here the diagnosis of "psychosis with psychopathic personality; unformed psychotic reactions of paranoid and depressive nature;

marked psychoneurotic admixtures" was entered in D's record, and she was discharged to await hospitalization at a state institution. If she actually was admitted temporarily to a state hospital at that time, the records do not show this. In any case, when Dr. Burks first saw her, about two years later, Doris was at home, making a fairly good physical recovery from a second paralytic stroke. The following year, just before a second visit by Dr. Burks, D was admitted to a state hospital for observation and treatment for an indefinite period with a diagnosis of manic-depressive insanity.³

SITUATION AT TIME OF STUDY (1942)

The twins were 39 years of age at the time of the study. At 17 Clara had married an older man, the only one with whom she had gone about. Her older daughter was born a year later, and four years later a second daughter. Six and eight years later her sons were born. Both of the girls were married before the study was made. All of the children were healthy and seemed reasonably well adjusted. All of them had had difficulty with reading in school but all were proficient in arithmetic. Apparently they lived the ordinary life of a family in the lower economic class. Clara had joined the Lutheran church with her husband, attended the Ladies' Aid Society, and belonged to two lodges. Her favorite recreation was driving the car and looking at picture magazines. She liked funny movies, but read almost not at all. She handled her children easily, was not at all strict with them,

³ During this year Doris wrote frequently to Dr. Burks and obviously derived very great support from this contact. Dr. Burks did a great many things for her and the family; she interceded with the Red Cross to aid Doris' husband in obtaining a better pension, corresponded with various welfare workers about them, and herself contributed to getting help in the home.

and gave them a good deal of freedom. They always had birthday parties, and their friends came to the house freely. Clara used a good many clichés in speaking. She cried easily and was somewhat excitable; was easily disturbed if things went wrong, or if she had been unable to plan ahead. Both she and Doris liked older people, and each of them found in her own neighborhood an older couple who could be depended on for talk and advice.

Doris married at 23, in what was perhaps an attempt to escape from her unhappy home situation. Unfortunately her husband was a shell-shocked veteran of the first World War, who was able to work only intermittently, and they always had great difficulty in getting along financially. Doris was his third wife. Her oldest child, a boy, was born before the marriage, and there were two other children, a girl two years younger, and a boy five years younger. The older boy finished ninth grade at 14 and had been working since. At the time of the interview the daughter was in ninth grade, but was helping out very little at home. The youngest at 11 was in fifth grade, but found school work difficult, especially reading. Doris was always very nervous, very uncertain with people, and unable to go with groups, for if anyone "looked at her" she cried and felt hurt. When things did not go well, she cuffed at her children. She had always been inconsiderate of others, and she insisted on talking loudly. She was "crazy about cats and dogs," commenting, "They can't answer back." She professed to prefer them to children. She had always been impulsive and whimsical in her conduct. Her favorite recreations were the same as her sister's, riding and pictures. She did, however, read a newspaper occasionally.

With all her own illnesses, whatever their etiology, and with her husband's disability, she had certainly had an extremely difficult time. When she was bedfast it was hard to get help in the house and the children tended to be ineffectual, although it is difficult to see how they could have learned to be otherwise. Her discovery of her twin sister and the ensuing friendly relations between them became steadying factors in her life.

TESTS, RATINGS, AND OBSERVATIONS

Intelligence tests. On the Kuhlmann-Stanford test given when the twins were 39, C received a mental age of 11 years, 2 months, an I.Q. of 70; D a mental age of 9 years, 9 months, an I.Q. of 61. (Three years earlier the university hospital had recorded D's mental age as 12 years, 4 months. It should be remembered that she had had two strokes in the intervening period.) Both had a basal age of 7 and Vocabulary at 10 years. C could repeat 8 Digits Forward, 3 Digits Backward; D gave 6 Digits Forward, 3 Digits Backward. C failed the Ball-and-field test altogether, while D gave a superior performance on it. Both succeeded with Abstract Words and Picture Interpretation

at the 12 year level; these, with the Ball-and-field were D's highest level performance, but C succeeded with Problems of Fact at 14 and Digits Forward at 18. So far as is indicated, Dr. Burks considered C's test representative and valid, but she noted that she would expect D to score an additional 11 to 15 months "if not fatigued or excited."

Descriptive rating scale. Twelve items were rated by Dr. Burks on the basis of direct observations made during the interview. These items were: physique (body build apart from height); manner (impression of masculinity-femininity); expression (clarity); talkativeness; neatness (in dress or person); courtesy; alertness; frankness; friendliness; poise; cheerfulness; emotional expressiveness.

A 5-point scale was used for these ratings, called a "Descriptive Rating Scale." The rating 1 in each case was the high end of the scale. These scales are given in Appendix A.

On 7 of the 12 items, C and D received the same ratings. Table 2 shows the items where differences appeared.

Trait ratings. In Table 3 are recorded a series of trait ratings for the twins, made by Clara's daughters and Doris'

TABLE 2
DESCRIPTIVE RATING SCALE COMPARISONS
TWINS CLARA AND DORIS

Characteristic	Twin C		Twin D		Steps (Diff.)
	Rating	Description	Rating	Description	
Physique	1	Overweight	3	Neither sturdy nor frail	2
Talkativeness	1	Extremely talkative	2	Quite talkative	1
Poise	2	Good self-control	4	Easily upset, often seems on verge of going to pieces	2
Cheerfulness	2	Light hearted	4	Rather sombre, pessimistic	2
Emotional expressiveness	2	Spontaneous	1	Extreme, almost no inhibition	1

TABLE 3
 TRAIT RATINGS OF TWINS CLARA AND DORIS
 MADE BY CLARA'S DAUGHTERS AND DORIS' SON

Trait	Rater	Degree				
		1	2	3	4	5
General health	C's daughters			C		D
	D's son			C		D
Physical energy	C's daughters			C		
	D's son		C		D	
Amount of activity	C's daughters	D		C		
	D's son	C D				
Sleep depth	C's daughters					C D
	D's son					C D
Reaction to pain	C's daughters		D		C	
	D's son		D		C	
Sympathy for family	C's daughters	C D				
	D's son		C D			
Sympathy for friends	C's daughters	C	D			
	D's son		C D			
Perseverance	C's daughters	C				
	D's son		C D			
Self-assertion at home	C's daughters	D	C			
	D's son	D	C			
Self-assertion in group	C's daughters					
	D's son		C		D	
Talkativeness at home	C's daughters	C D				
	D's son	C	D			
Talkativeness in group	C's daughters	C				D
	D's son			C D		
Promptness	C's daughters	C	D			
	D's son	D		C		
Speed of decision	C's daughters		C D			
	D's son		D	C		
Generosity	C's daughters	C D				
	D's son					
Self-consciousness	C's daughters	D		C		
	D's son		D	C		
Sense of responsibility	C's daughters	C		D		
	D's son		C D			
Sense of humor	C's daughters		C D			
	D's son				C D	
Irritability	C's daughters	D	C			
	D's son		C	D		
Cheerfulness	C's daughters			C	D	
	D's son			C	D	

TABLE 3—(continued)

Trait	Rater	Degree				
		1	2	3	4	5
Courage (physical)	C's daughters	D	C			
	D's son		D		C	
Courage (moral)	C's daughters			C D		
	D's son	D		C		
Facing facts	C's daughters				C D	
	D's son		C D			
Trustfulness	C's daughters	C		D		
	D's son	D		C		
Sociality neighbors	C's daughters	C		D		
	D's son	D	C			
Sociality strangers	C's daughters	C				D
	D's son		C			
Leadership	C's daughters					D
	D's son		C			D
Popularity same sex	C's daughters	C		D		
	D's son	C D				
Emotional dependence on family	C's daughters	D		C		
	D's son					C D

son, the former working together. Hence there are two ratings of each twin on each trait. The following description of this schedule is taken from Burks' "A Study of Identical Twins Reared Apart."⁴

". . . For the present study each 'trait' was set up in five descriptive steps; the concept of 'Average' was not used. With behavior (e.g., talkativeness, self-assertion) that, on the basis of clinical experience, the writer believed to be situational (i.e., to represent adaptations in defined social groups) and with behavior capacities that experimental work in psychology has shown to be mainly specific (e.g., memory), the trait descriptions were narrowed down. With behavior believed on clinical grounds to be 'focal' in Allport's sense, the 'steps' were carefully defined but were not limited in a situational sense. Examples from the schedule:

"Physical energy: S D 1. abounding vitality, seldom tires. 2. Large amount but sometimes 'overdoes.' 3. Good endurance for routine activity but soon fatigued by strenuous activity. 4. Unable to carry on any strenuous activities.

5. Tires at slight exertion; exhausted at end of day.

"Competitiveness: S D 1. Extremely eager to win games, unhappy when he loses. 2. Very eager to win but not discouraged by losing. 3. Fairly eager to win but enjoys the success of others. 4. Indifferent to winning; cares only for fun of game. 5. Prefers to play with and learn from players better than himself."

The complete rating schedule on physical and sensory traits is given in Appendix B.

As is quickly seen from Table 3, there is considerable discrepancy in the ratings. In some instances it is fairly clear that the son or daughters are favoring their own mother. Of the 25 pairs of ratings by C's daughters, 8 are the same, 6 are one step apart, 9 are two steps apart, 1 is three steps apart, and 1 is four steps apart. Of the 27 pairs of ratings of the twins by D's son, the twins receive the same rating 11 times, ratings differing

⁴ See Reference 1.

by one step 7 times, by two steps 8 times, and by three steps once.

Both sets of ratings agree that the twins are *alike* in sleeping very lightly, in sympathy for their family, in their sense of humor, and in the way in which they face facts, although the numerical ratings assigned by the two sets of raters are different except in the first instance. C and D are probably very alike also in their sympathy for friends, in talkativeness at home, and in speed of decision. (Based on closeness of agreement of averaged ratings where original ratings were not more than one step discrepant.)

Both sets of ratings agree that the twins are *unlike* (ratings discrepant by two steps or more) in health and reaction to pain, with agreement by both raters that Doris is the more stoical of the two. There is no agreement on other points. Although it does not come out clearly in the ratings, in part because of some omissions, the twins appear to be also very unlike in their reactions to persons new to them, and in their general social behavior outside their close circles of family and friends, Clara being judged as the more sociable of the two. Neither has any special artistic, musical, or mechanical aptitudes.

Rorschach test. The Rorschach test as administered by Dr. Burks at the time of her first visit in 1940 did not include the standard Inquiry nor full identifying notes on the areas of the blots to which responses were made (location). The protocols were reviewed by Helen Davidson, Ruth Valentine, and Anne Roe. All three were in agreement that at the time of the test Clara was more disturbed than Doris. This finding is of interest in view of the fact that D was later hospitalized with the diagnosis of manic-depressive psychosis. It gives evidence that

at the time of the test D was not in either a manic or depressive episode. It suggests that both twins were emotionally unstable, though manifestations of this instability differed.

Dr. Davidson's comments on C's Rorschach were: "Very disturbed; average intelligence or a little better." Her comments on D: "Average intelligence or better; rather rigid, flat, but adjustment seems adequate (?)."

The responses are recorded in Table 4. Although the inadequacies in the recording of the protocols make scoring and interpretation highly tentative, Dr. Valentine proposed the psychograms given in Appendix C and the following comments as approximate:

"There are striking similarities in the two psychograms: below average number of responses; proportion of correct Form responses near lower border of normal range; number of Popular responses below average; narrow range of Content; absence of Movement responses; great difficulty with Card X. There are some similarities in phrasing content (Cards VI and VIII, and possibly II), but the similarity in VIII is the usual "popular" response of the climbing animal, and the response "colored rocks" occurs fairly frequently. Neither has any Form-Color response. Intelligence of both is probably low average, at best.

"Differences are that C, compared to D, pays less attention to the obvious details of the cards; C has four possible Shading responses, whereas D has only one. C uses Color in the cards more than D.

"At the time these records were taken C was more disturbed than D. She appears to be an anxious, very insecure, and dependent person though she tries ineffectually to do what is expected of her. Greatly in need of reassurance, she has little or no feeling of confidence in her relations with others, unless they are fostering and helpful. The world to her is a frightening place; only the simplest situations can she deal with alone. She easily becomes bewildered and uncertain. But she does not completely give up the struggle. She blunders along, unsure of herself, hoping that someone will come to her rescue. With fostering care and supervision she can make a social adjustment, but left to herself she is more liable to make a wrong than a right

TABLE 4
 RORSCHACH PROTOCOLS
 TWINS CLARA AND DORIS

Twin C	Twin D
I. (5") 1. If it had an opening, make it you think of Hallowe'en mask. 2. Or parts of body like in here; what do you see in books like lungs in chicken. 3. Over it is much look like face. √	I. (4") 1. Pair of dogs that is all I'd say. 2. In middle a crab like. Don't look like dog poison?
1 1/4 min.	1/4 min.
II. (3") 1. Oh, gravy! only thing, parts of elephant with trunks together, a quick sketch (turns) nose and ears. <Something trying to catch it? 2. If looked at quick, like Scotty dog.	II. (3") 1. Two dogs right enough. Smelling at something. Ain't eating. Hurting, bleeding.
1 1/4 min.	1/4 min.
III. (Immed.) 1. Oh, lord save me! Nothing. Like spurs or claws, chicken foot. 2. If look quick, like chicken with sore foot and wing up back. Other one reversed.	III. (4") 1. Ducks on edge of pond. Something like that.
3/4 min.	1/4 min.
IV. (5") √ 1. Some pieces of your body internally, or like chicken, or human person; some parts of body by chest.	IV. (12") 1. Hm. Couldn't tell you nothing. Bear or something.
1/2 min.	1/2 min.
V. (Immed.) 1. Oh, that reminds you of one of these butterflies that has large noses on.	V. (3") 1. Butterflies. > 2. Heads or. 3. Lambs leg.
1/4 min.	3/4 min.
VI. (Immed.) 1. Oh, gravy! Not anything that I can see. A caterpillar if didn't have such long neck. Some kind of bug.	VI. 1. Worm, big fuzzy worm. That's all.
3/4 min.	1/4 min.
VII. (7") 1. Not anything. √ Nothing but large sketches or something unless clouds drifting along.	VII. (15") 1. Like lion's head a little. (middle)
1/2 min.	3/4 min.
VIII. (7") 1. That makes you think of bear going up over some colored stones. > Same this way.	VIII. (5") 1. Like a bear climbing over rocks, different colored rocks.
1/2 min.	1/4 min.
IX. (10") 1. Not anything, for that matter, that I can see. Unless it happened to be light and dark clouds or something like that.	IX. (10") √ 1. Picture of man (red profile) rest of it don't know.
3/4 min.	1/4 min.
X. (20") 1. Oh, dear, √ not anything that I can see on this problem. Nothing but little dab of this and dab of that.	X. (25") ∧ √ 1. Don't know what you'd call it, some kind of scene hitched together, skies conj (sic) together.
3/4 min.	(no time)

Four score and years ago our father brought forth
upon
this continent a new nation conceived in
liberty and dedicated to the proposition
that all men are created equal

FIG. 1a. Handwriting. Clara.
Time: 5' 05".

Four score and seven years ago father forth
in this continent, a new conceived in
liberty and dedicated to
the ~~proposition~~ proposition that all are
created equal.

FIG. 1b. Handwriting. Doris. Time:
5' 30", including nervous pause.

choice. She is not psychotic but is a person inadequate to deal with the problems of adult life except in a simplified and undemanding environment.

"D, though less disturbed at the time the Rorschach was administered, may have more potentialities for conflict with others. She seems to be more crude and less dependent than C. Less anxious, she appears to be socially a more intractable person. Her impulses, not held in check as are C's, by anxiety, may lead to difficulties with people—resentments, hostilities, emotional vagaries which are directed more against others than are C's. Superficially, D has a 'take it or leave it' attitude, whereas C will be more placating and anxious, using her helplessness as a bid for support. But with D, one suspects that this attitude of 'take me as I am' is defensive and that underneath this she is as desirous of affection and help as is C."

It is of interest to note that this interpretation of Clara's insecurity in her relations with people, based on her Rorschach record, resembles strikingly in some respects the overt behavior of Doris in her relations with others.

Handwriting. The two handwriting specimens reproduced in Figures 1a and 1b show very great similarities. But it should be remembered, of course, that Doris taught Clara to write.

SUMMARY

The twins Clara and Doris, among the youngest of 14 siblings whose history includes numerous instances of unstable maladjusted behavior, were separated when less than two years of age, and shortly afterward adopted by two different families. The chief environmental differences were as follows: for Clara (Twin C), residence in moderate sized city, only child of fond foster parents, extremely mild discipline, regular school attendance until fifth grade, marriage at 17 to stable older man; for Doris (Twin D), residence in large city, one of three children, in household with harsh foster parents, extremely strict discipline, intermittent school attendance, marriage at

23 to shell-shocked veteran. Neither C nor D did well in school, though D did manage to learn reading and writing. Both C and D left school at the age of about 12, and both held a series of odd jobs until they were married. The socio-economic status of their families was similar.

In their developmental histories the twins showed some striking similarities. Both reported "growing pains," early menarche, menstrual headaches, "nervousness," hysterical loss of voice, childhood sties, eczema and eye strain from an early age, and gynecological repairs. D's medical history is much more extensive than C's, however, including a series of subsequent operations and ailments some of which were presumed to be of neurotic origin.

Tests, interviews, and ratings were obtained when the twins were 39 years of age. At this time the twins were living in the same community and were close friends. Clara was engaged in a normal, moderately active life with her husband and two unmarried sons. Doris was discontented with her lot, and irritable with her children. She had been diagnosed as "psychotic" and a year later was hospitalized as "manic-depressive." The twins both scored well below average in intelligence, and neither gave evidence of any special abilities.

Despite their markedly different upbringing, the twins were judged by the interviewer to be "the same" on more than half of the 12 social and emotional characteristics which she rated, the chief differences being that D (psychotic, maltreated in childhood) is pictured as more easily upset, more pessimistic, and more free from inhibitions. Less consistency is found in the ratings of physical and sensory traits made by C's and D's chil-

dren, partly perhaps because of personal prejudices found in these raters.

Certain striking similarities in response to the Rorschach test were noted and

evidences of emotional instability were present in both records, though that of C showed the more disturbance at the time.

CHAPTER III

TWINS EARL AND FRANK

THE TWINS Earl and Frank were born in a large Midwestern city in 1904. Their parents were unmarried, and according to Earl's account, neither had ever had much formal education. The father worked for a utility company. He and the mother later married and had two other children, but the twins never had any meaningful contact with them after the age of about six months. It was at this age that the babies were turned over to the mother's sister, Fern, who kept Frank and placed Earl with a family who had advertised their wish to board a baby. This family soon assumed full responsibility for Earl and took him to a city in the Northwest without consulting Fern or her husband, although later they got in touch with them again.

Frank remained with his Aunt Fern, who was fond of both twins and who, along with other members of the family, wished she could arrange for Earl to return so the two could grow up together. The foster families kept in touch with one another and the boys were led to believe that they were cousins. When they were 15, Frank made a trip to the West Coast to visit Earl, but it was not until eight years later, when Earl returned the visit, that the boys learned they were twins. They seem to have accepted the family history with equanimity.

EVIDENCE FOR MONOZYGOTIC ORIGIN OF THE TWINS

Again, comparison of E and F on physical traits leads to the conclusion that they are monozygotic. As indicated in Table 5, the twins at 37 were of practically identical height, and although F

was 24 pounds heavier than E, they looked very much alike. Both were getting bald in the same front central area pattern (like their father). Both were righthanded. E stated that he stuttered until he was in the second year of college; he was sent to a speech school but finally "worked out of it" himself. He said that so far as he knew his handedness had not changed. He explained the speech difficulty as due to the fact that he thought faster than he could speak.

ENVIRONMENTAL SURROUNDINGS AND HISTORY

Community. Earl's foster parents moved to a large Northwestern city not long after they took him. They remained there for a few years and then moved elsewhere in the West, where Earl went through a big city high school and a nearby university.

Frank was brought up in the Midwestern city where he was born, and remained there until his visit to the West when he was 15. After about six months with Earl, he returned home for two years. Then he went to a Midwestern city to work and "for adventure." He never lived outside of an urban community.

The foster homes. Earl was brought up as an only child. His foster father was a college graduate, his foster mother a high school graduate. His foster father was a salesman, apparently fairly successful, as the family always lived in a detached house with a yard, and Earl indicated that there had been no economic stress in his youth.

According to his own account, he was brought up in a comfortable home,

TABLE 5
PHYSICAL CRITERIA OF ZYGOTIC ORIGIN
TWINS EARL AND FRANK

Age 37 years	Twin E		Twin F	
Height (stocking feet)	164.6 cm.		164.4 cm.	
Weight (with clothing)	163 lb.		187 lb.	
Head breadth	15.0 cm.		15.3 cm.	
Head length	19.2 cm.		19.3 cm.	
Cephalic index	78		79	
Head circumference	22.0 inches		22.6 inches	
Interpupillary distance				
Left reading (3)	5.8 cm.		5.6 cm.	
Right reading (3)	5.7 cm.		5.1? cm.	
Eye color (Martin chart)	5		5	
Inner zone			Wider	
Outer zone	Brown center			
Need for glasses	Never		Never	
Hair:				
Form	Straight		Same	
Medullation	6%		2%	
Type	Discontinuous		Discontinuous	
Pigment granule pattern			Same	
Color	Light brown		Slightly lighter	
Average diameter shaft	90 microns		60 microns	
Cortical fusi	Few and slender		Markedly more numerous	
Cortical scales			No form differences	
	Same baldness pattern, front central area			
Oral cavity:				
Occlusion	Imperfect overlap		Better overlap	
Tongue furrows	None		None	
Form of ear	Same shape			
Feet:				
Size of shoe	6		6	
Hands:				
Mid-digital hair	R ₄ ?		None	
Downy hair:				
Arms	Thick and black		Same	
Chest	Thick and black		Same	
Handedness	Right		Right	
Fingerprints:				
Thumb	R	L	R	L
Index	L ^u 27	L ^u 24	TL 26-1	TL 20-1
Middle	L ^u 5	L ^u 11	L ^u 4	L ^u 11
Ring	L ^u 12	L ^u 7	L ^u 7	L ^u 3
Little	L ^u 14	L ^u 17	L ^u 19	L ^u 15
Total ridge counts	L ^u 13	L ^u 15	L ^u 15	L ^u 8
Diff. in ridge counts:	71	74	72	58
bilateral, 17				
homolateral, 17				
heterolateral, 15				

by parents who were happily married, and who handled him without particular strain. They took him with them when they went visiting, welcomed his friends at any time, gave parties for him. He enjoyed being with them and felt free to confide in them. He was expected to feed the chickens, cut the lawn, and take some part in caring for pets, and he was taught to obey. He could "work" his mother but not his father, who always punished him when he said he would. These punishments were rare, though, and it is apparent that discipline was not at all severe. He had no regular allowance but was given what he needed. His pleasantest memories were of the family's being together and talking happily about the day's routine, and of trips they took together. His only unpleasant memories were of some occasions when the father drank too heavily with his customers. Earl was sent to Sunday School, probably for the sake of social conformity rather than because of any strong religious feeling. The family library included children's books which he enjoyed, and he had violin lessons from the age of 14 to 17 years. At the time of the study he played occasionally, and he commented, "I take to it more now than I did then."

Frank lived with his Aunt Fern and her husband, a streetcar conductor, in one room. They moved from one rooming house to another, but stayed in the same neighborhood where the twins were born. There were no other children in the family. Fern and her husband were separated when Frank was about 12, and after that he spent a good deal of time with his grandmother. Frank's report indicates a reasonably happy childhood. His foster mother was extremely attached to him. (Frank and his wife later

named their daughter Fern.) He helped with domestic tasks such as wiping dishes, scrubbing floors, and hauling coal, for which he was paid "haphazardly" but was never cheated. He had no regular allowance. He was punished only "when he deserved it," as when he came home late. His mother whipped him; his father "talked to him." But he remembered both as being consistent in their rules about what he could and could not do. He always had cats and kittens and took full charge of them. When he was about 12 his parents arranged for him to have violin lessons. These did not "take," however, and were soon abandoned.

Education. Earl went to city schools in the Northwest and West and through a large university from which he graduated in 1930 at the age of 26. The next year he spent as a hospital orderly, with the idea that he might return to the university to study medicine. His foster parents hoped he would do so, but according to E, these plans were thwarted the following year by the illness and death of his foster father, whom he cared for at home. Earl did do some postgraduate work, with the thought of becoming a teacher, but gave up this goal when he failed to be appointed to the local city schools. E spoke defensively of this failure, blaming it on a system of rating which unduly weighted the experience he lacked. It is probable that his professional aspirations were too high; they tended to lessen appreciably the pleasure he took in the success of his business operations.

Frank had considerably less schooling than Earl, and was perhaps in poorer schools. He graduated from grammar school at 15, having had to take a summer make-up course in arithmetic after sixth grade. The following year, while

visiting his brother in the West, he attended high school for about six months. This he reported to be about the extent of his high school experience, although many years later, after his daughter was born, he attended night school for four years, taking courses in typing, welding, and chemistry.

Both twins were poor spellers, and transposed letters, as did Frank's daughter.

Occupational history. During his school days Earl had various jobs, during summers or after school hours. His position as hospital orderly the year following graduation from college has already been mentioned. E did not return to nursing as a profession, however, because he considered its future financially uncertain. Instead, he acquired a service station which he owned and operated for some years, then sold at a profit. He spent another two years selling service station equipment. About a year and a half before the study was made he gave up his selling job in the city to take over the management of a suburban cafe. It is interesting that his brother was the one who found this particular cafe and called Earl's attention to it. This was his job at the time of the study. He was more satisfied with this than with his previous occupations but talked of selling out, taking a trip, and looking around.

Frank began work when he left school at 16 or 17, and had a number of jobs, most of them, until the one he held when interviewed, as tire serviceman or salesman or garageman. During the depression he was unemployed for nine months and there were undoubtedly some difficult times. He moved to the West when he was 26, and had continued to live there. At the time of the study he was

living in the same suburban community as Earl, having held his job as a modestly paid laborer with a utilities company for the seven preceding years.

Health history. The reports of Earl and Frank indicate histories notably similar and free from health problems. Both had measles and whooping cough in childhood, but neither had any serious illnesses, except for one severe attack of bronchitis, which F had at 34. Each of the twins stated that his own general health was good, that he seldom became tired, and rarely had colds or headaches. Both reported good hearing, and neither had ever needed glasses.

SITUATION AT TIME OF STUDY (1941)

When the twins were interviewed Earl was working hard, and with reasonable contentment, at running his suburban cafe. He took considerable pride in his success; he seemed almost defensively self-satisfied. He had married at 27 a laboratory technician in the hospital in which he was then working as relief orderly. His wife was a college graduate. They had no children, but it seems to have been a successful marriage. They had some friends nearby, people they met when they first came to the restaurant, but most of their friends were in the larger city from which they had moved. They made trips to the city every three or four weeks, and friends from there came to visit them. They saw Frank about one night a week. Neither E nor his wife participated in community life in any particular way, and both spent their leisure time reading, or driving, or playing cards with another couple. E's wife said he was of a "steady temperament," but one of his friends described him as "moody." His wife added, "Earl doesn't stew about deci-

sions, and there's no turning back when he makes up his mind."

Frank was also married, to a girl from the neighborhood of his childhood. Their daughter, Fern, was 13 at the time of the interviews. The family relationships seemed to be very warm and close and the home atmosphere relaxed and comfortable. F's wife had completed three years of high school and had then worked as a telephone operator, continuing for a couple of years after their marriage when she was 20. He was fairly contented with his job, except that opportunities for advancement were not many. He got on well with his neighbors, but most of his friends were people he worked with. He played handball quite regularly with a group of men and "loved" to play cards—especially poker. He greatly enjoyed his friends, and liked nothing better than to visit with them for an evening. He occasionally played his violin, chiefly by ear, but only if others played too. E played with him sometimes. The family usually took a camping trip once a year with friends. Their daughter had originally accompanied them, but later on preferred her own friends, a fact which her parents accepted with equanimity. F's wife said he was calm about decisions and did not worry about things. He was a little quick-tempered, sometimes unexpectedly, but was shortly over it. Both twins liked prize-fights and often attended together.

Earl and Frank seem rather well characterized by their responses when asked what three things they wished most.

Earl wanted: "1. A good business of some kind, a wholesale line of some kind with men working for you. 2. A comfortable living and home; we've got a home but don't live in it. 3. Travel, around the U.S. We've been around the

U.S. but we'd do it more thoroughly, a week here, stop and work if found a job."

Frank wanted: "1. Happiness of my family. I don't want to be wealthy, just for them to be taken care of. 2. Betterment of this country. [Interviewer's note: This was said simply and with apparently sincere feeling.] And for 3, he turned to his wife and said, "I'll let you wish this time." When his wife turned it back to him, Frank thought a while, then said, "I'm easy pleased."

TESTS, RATINGS, AND OBSERVATIONS

Intelligence tests. On the Stanford-Binet (1916) E passed all the tests through 12 years, failed all at 18, and reached a Mental Age of 15 years, 4 months, with an I.Q. of 96. At the 14-year level he failed 7 Digits forward and at 16 years the Difference between Abstract Words and the Code. His Vocabulary was at the 16-year level (67 words); he repeated 6 Digits forward and the same number backward.

F's basal year was 10 and he failed all tests at 18 years; his Mental Age was 13 years, 4 months, his I.Q. 83. Of the 12 year tests he failed the Dissected Sentences and Digits backward; at 14 years he failed Induction, President-and-king, and Arithmetical Reasoning (over time), and at 16 years he succeeded only in the Fables and the Difference between Abstract Words (which E failed). His Vocabulary was at the 14 year level (58 words); he repeated 4 Digits backward. On Digits forward only the failure at 18 years is recorded.

Descriptive rating scale. Dr. Burks' ratings on the 12 items on the descriptive rating scale are identical for the twins in all but three instances, where the discrepancies are slight. For clarity of expression and talkativeness, E is rated 2.5

in each instance and F is rated 3. On emotional expressiveness E is rated 4, F 3, that is, somewhat less reserved.

Mrs. Newman,⁵ who also interviewed these twins, rated them differently on physique (E 1, F 2); manner (E 1, F 2); courtesy (E 2, F 3); frankness (E 2, F 1); cheerfulness (E 3, F 2); and emotional expressiveness (E 4, F 2).

On the 24 ratings of the two men, the two raters agreed in 8 instances for E and only 5 for F. There were no disagreements greater than one step.

Trait ratings. Ratings on physical and sensory traits were made by the wives of the twins for each twin and recorded by Mrs. Newman. They are shown in Table 6. Examination of the table shows that F's wife had a strong tendency to give higher ratings⁶ to both men, the tendency being a little stronger with regard to her own husband. Since these higher ratings are usually somewhat more approving, or at least more positive ones, they probably reflect fairly marked differences in the personalities of the two raters. Apart from this tendency, it is clear that the wives agreed that their husbands were alike in health, energy, appetite, reaction to pain, sympathy for family and friends, self-assertiveness at home, promptness, irritability, physical courage, facing facts, popularity with both men and women, and emotional dependence on their families. They agreed that they were notably different in sociality, with F the more outgoing of the two. They also agreed that F was more "trustful" than E, a judgment which appears consistent with E's

"defensiveness" as noted by the interviewers.

Some interesting sidelights on the ratings are contained in comments by Mrs. Newman based on conversations, observations, and joint discussion with Dr. Burks at the time of the study:

"Earl, with whom all preliminary arrangements for the interviews and tests were handled by correspondence, from the first spoke of his brother with condescension. Before Frank was scheduled to arrive at the cafe, Earl took us aside to warn us that he had not broached the subject of our visit to Frank, and that he did not know how F might feel about it, implying that F might be edgy and uncooperative. Thus on our guard, and armed with all the tact at our command, we were more than surprised to find F if anything readier to cooperate than E. F. was more relaxed and unpretentiously friendly in his contacts. E's assumed apprehensions regarding his brother's behavior seem to be part of a whole pattern of life he has adopted, in which his status as a highly educated, successful gentleman figures very prominently and must be carefully preserved. He never forgets the burden of *noblesse oblige* he has shouldered along with his superior educational and social advantages."

In addition to the resemblances and differences indicated by the ratings, it was noted that both E and F played a little on the violin, enjoyed the same kind of music, liked natural beauty, had considerable mechanical ability, enjoyed working around cars, and the like. On the other hand, neither of the twins had any marked interest in art, neither sang, wrote, nor manifested any special talent, and neither of them indulged in or developed skill in any physical activity, except that F played handball.

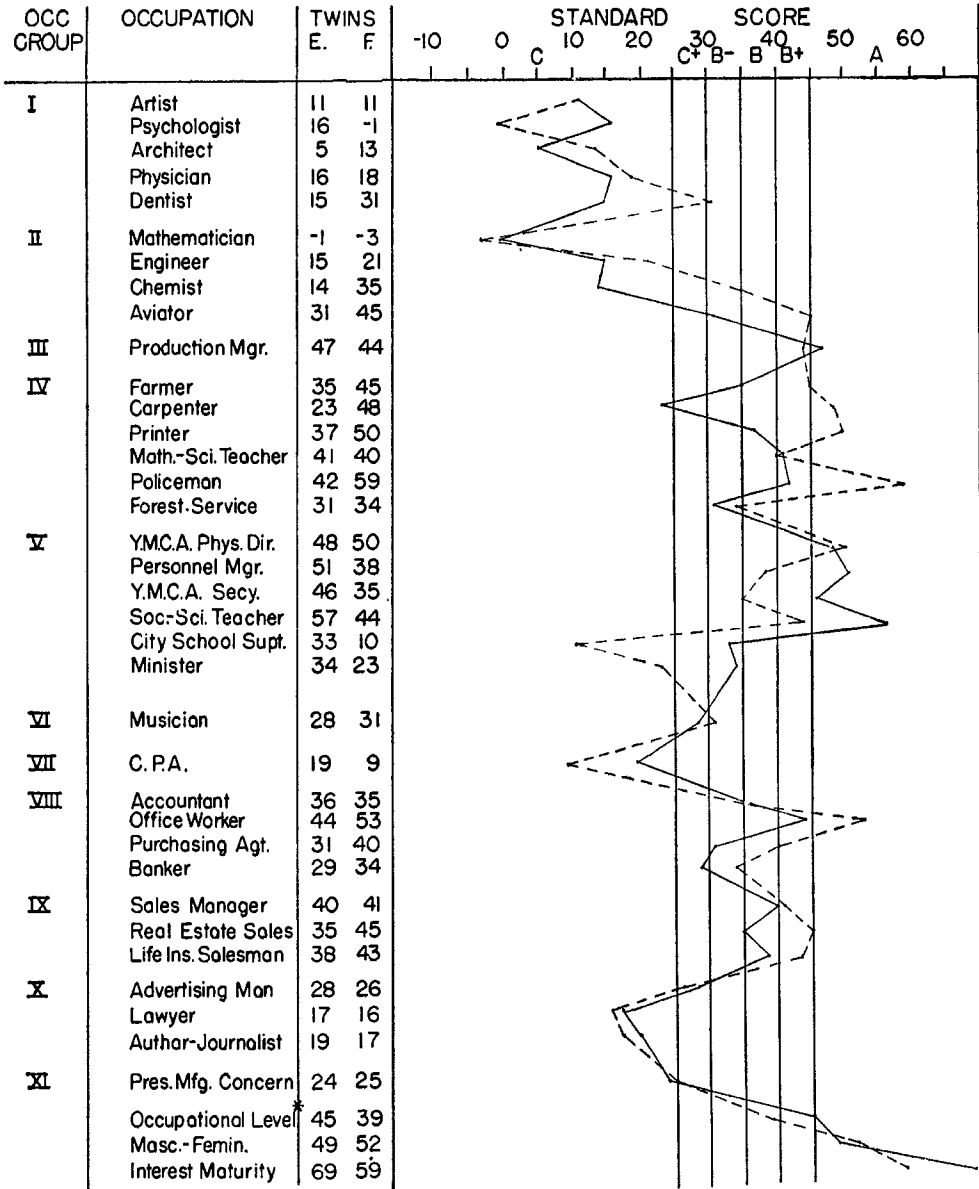
Strong Vocational Interest Blank. In Figure 2 are shown the vocational interest patterns of E and F, at the age of 37. The profiles show striking similarity and parallel each other closely, in spite of the fact that the most outstanding differences in the upbringing of E and F were related to vocational and social

⁵ Frances Burks Newman accompanied Dr. Burks when she visited the twins Earl and Frank in 1941.

⁶ "Higher" here refers to a more marked manifestation of a trait; on the scale the rating "1" is "high," "5" is "low."

STRONG VOCATIONAL INTEREST PATTERNS
FOR TWINS E. AND F. AT AGE 37

E: ——— F: - - - -



* Occupational level is a measure of the amount a given score differs from the average of unskilled laborers. Hence a high score means one's interests are "elite" in the sense that they are like those of professional men rather than laborers.

FIG. 2. Vocational interest patterns, Earl and Frank.

TABLE 6
 TRAIT RATINGS OF TWINS EARL AND FRANK
 MADE BY THEIR WIVES

Trait	Rater	Degree				
		1	2	3	4	5
General health	E's wife F's wife	E F	E F			
Physical energy	E's wife F's wife	E F E F				
Amount of activity	E's wife F's wife	E		E F	F	
Appetite	E's wife F's wife		E F E F			
Sleep depth	E's wife F's wife		F?	F?	F	E
Reaction to pain	E's wife F's wife	E F	E F			
Sympathy for family	E's wife F's wife	E F	E F			
Sympathy for friends	E's wife F's wife	E F	E F			
Perseverance	E's wife F's wife	E F	E	F?		
Self-assertion at home	E's wife F's wife	E F		E F		
Self-assertion in group	E's wife F's wife			E F		
Talkativeness at home	E's wife F's wife		F	E E	F	
Talkativeness in group	E's wife F's wife		F	E E	F	
Promptness	E's wife F's wife		E F	E F		
Speed of decision	E's wife F's wife		F F	E E		
Jealousy of spouse	E's wife F's wife	F	E F?			
Generosity	E's wife F's wife	F F	E E?	E?		
Self-consciousness	E's wife F's wife				E F E	F
Competitiveness	E's wife F's wife		F E F		E	
Sense of responsibility	E's wife F's wife	E F	F			

TABLE 6—(continued)

Trait	Rater	Degree				
		1	2	3	4	5
Sense of humor	E's wife F's wife	E F F	E			
Irritability	E's wife F's wife			E F		E F
Cheerfulness	E's wife F's wife	F	E F			
Courage (physical)	E's wife F's wife		E F E F			
Courage (moral)	E's wife F's wife	E E F				
Facing facts	E's wife F's wife	E F?	E F			
Trustfulness	E's wife F's wife	F	F	E	E	
Sociality	E's wife F's wife	F F		E E		
Leadership	E's wife F's wife	E F	E			
Popularity same sex	E's wife F's wife	E F	E F			
Popularity opposite sex	E's wife F's wife	E F	E F			
Athletic interests	E's wife F's wife	F	F	E	E?	
Emotional dependence on family	E's wife F's wife		E F	E F		

ambitions, so that we might expect to find some of the greatest differences between the twins to be in this area.

Of the 38 pairs of scores, 25 differ by no more than 10 points of standard score, which is one standard deviation of the distribution of the criterion group. Seventeen pairs are within 5 points standard score of each other. Only three pairs differ by as much as 20 points in standard score, or 2.0 standard deviations of the criterion group distribution.

In "A Study of Identical Twins Reared

Apart" Dr. Burks notes the markedly greater similarity in the vocational interest schedules of Twins A and B at age 18 than at age 12, and she suggests that "interest patterns, as maturity is approached, not only become stabilized but actually have a closer relation to native potentialities than do interests in early adolescence."

In the light of this hypothesis of Dr. Burks, attention may be called to the close parallelism of vocational interests in these mature twins E and F, despite

the background influences which might have been expected to steer them in different directions.

Rorschach test. The Rorschach tests were administered by Dr. Burks. There is no Inquiry for either E or F, although some locations for E's responses have been indicated on a "location chart" with some elaboration of his responses. These, however, add little to the protocol for they are chiefly inaccurate anatomical details. The protocols of Earl and Frank are given in Table 7.

Dr. Davidson's comments on E's Rorschach were: "Above average intelligence; poor affective relationships, rigid; self-conscious; very weak ego; adjustment fair." Her comments on F's Rorschach: "Above average intelligence; very insecure about himself (see Card III), weak ego; responsive; probably adequately adjusting (?)."

Dr. Valentine agrees, with one major exception: she would infer that neither E nor F was more than average in intelligence. She also infers that F's ego is less vulnerable than E's. She has submitted approximate psychograms for E and F, given in Appendix D, and has added the following comments:

"The chief similarities in these two psychograms are: below average number of responses; narrow range of Content; preponderance of Whole responses at the expense of the usual Details; absence of Movement responses; absence of Form-Color responses.

"Differences in the psychograms are: E has a much lower percentage of good Form responses than F, fewer Popular responses, more Color responses, and a more limited range of content.

"Qualitatively, the striking difference between E and F is the strained effort of E to impress, to show that he is above the common run of people. But there is a wide gap between his aspirations and his ability to make these good. F, on the other hand, is more simple and unpretentious, less eager to impress people, somewhat more capable of easy relations with them. Both are of average intelligence but E wishes

to be accepted as superior; he is 'cagey' and unwilling to give himself away, hides his inadequacies under a rather empty pomposity. He appears to be more emotionally unstable than F and to make an attempt to deal intellectually with his feelings whereas F tends to accept his. F shows humility about himself—which he possibly uses as a technique of ingratiation."

Handwriting. The samples of the handwriting of these twins are reproduced in Figures 3a and 3b. Although these are superficially much less alike than those of the first pair of twins, there are a number of points of similarity.

SUMMARY

The monozygotic twins Earl and Frank, born out of wedlock of parents with little education, were separated at the age of six months and raised by adoptive parents in different areas of the country. They did not see each other again until the age of 15. The chief environmental differences were as follows: Earl (Twin E) lived in cities in the Northwest and West, in comfort and economic security, and was encouraged to attend college and to embrace professional ambitions somewhat beyond his intellectual capacities. Frank (Twin F) was brought up by a maternal aunt and her husband in the economic and social milieu in which the twins were born, with little economic security or even physical comfort but with marked affection from his aunt. F had considerably less schooling than E and was not pushed toward ambitious achievements. Similar environmental influences were that both twins enjoyed reasonably happy childhood homes and moderate discipline, though F's training may have been somewhat more consistent. Both twins were exposed to violin lessons.

Developmental and health histories were very similar; each twin commented on his own good general health and high

TABLE 7
 RORSCHACH PROTOCOLS
 TWINS EARL AND FRANK

Twin E	Twin F
I. (at once) A pelvic bone . . . √ (can I turn)? . . . it still does. (no time)	I. Bat √ Some emblem of some sort. 1 min.
II. (10") Looks like a type of bug of some kind. (no time)	II. (15") √ < Basis of these monsters. . . Looks like a cat that's scared, a bobtailed cat. ¾ min.
III. (12") A spider. (no time)	III. (10") √ Are these supposed to represent something? A sea horse Butterfly Also the features of a man's head with mouth open. 1¼ min.
IV. (at once) A bat. (no time)	IV. (10") Has the features of some sort of worms. Don't know whether to call him cousin of bat or not (laughs). ¾ min.
V. A butterfly. (no time)	V. (20") Don't believe I ever saw anything like it . . . afraid I'm kind of dumb. Ani- mal life . . . could be cousin of a bat. ¾ min.
VI. (15") (turns around) A skin of some ani- mal. (no time)	VI. (20") More like a rug to me. Lacking head, could be a bear rug. ¾ min.
VII. (turns around) (40") That one I wouldn't say much; similar to islands geographically. ¼ min.	VII. (15") Sort of like clouds. Could be look- ing down from airplane at ridge of moun- tains. ¼ min.
VIII. (at once) Looks like a cross section of some embryo, stained . . . microtome section, different types of tissue. (no time)	VIII. (15") Looks like animals trying to hang on to something . . . color effects are very pretty (smiles). ¾ min.
IX. (30"); (turns around) Some type of deep sea life. (no time)	IX. (15") Earl Carroll's(?) night club. Have colors just about like that. Looks like fountain and neon lights. ¾ min.
X. (15") Same thing, cross section of some ani- mal, types of tissue taking different stains. (no time)	X. (8") Without colors would say in a stream of water where bugs are floating around (turns) ½ min.

Four score and seven year ago our
father brought forth upon this continent
a new nation conceived in liberty and
dedicated to the proposition that all
men are equal.

FIG. 3a. Handwriting. Earl.

"Four score and seven years ago
our father brought forth upon this
continent a new nation in liberty
and dedicated to the proposition that
all men are created equal. -

FIG. 3b. Handwriting. Frank.

energy level. In appearance they were markedly alike.

When studied at the age of 37 both twins were living and working in the West, E running successfully a suburban cafe, F employed as a laborer in a utilities company—an occupation which was that of his own father. Both were married, both had friends with whom they liked to associate. E's ambitions and desire for worldly success were strong and not entirely satisfied, while F was more relaxed and contented with his lot.

Intelligence tests showed E's I.Q. to be in the normal range, F's in the low normal. Ratings by Dr. Burks on characteristics observed during the interviews were identical in three fourths of the items. Ratings by the two wives of the twins on certain physical and sensory traits showed agreement that both E and F were alike in many points and notably different only in two: sociality and trustfulness of others, F being the more outgoing and trustful of the two, and warmer in his personal relations.

CHAPTER IV

TWINS GERTRUDE AND HELEN

THE TWINS Gertrude and Helen were the two survivors of a set of triplets (the third triplet lived only a few months) born in the Northwest in 1889. Each weighed about three pounds at birth. The parents were Finnish immigrants. The father was well educated, but the mother illiterate. Gertrude was taken by foster parents when she was about a year old, while Helen remained with her own parents who went to a remote farm. The motives of the parents in placing Gertrude for adoption are not clear, since later they had two younger children, but perhaps the difficulties of caring for twin babies made it seem to them desirable.

Gertrude did not know she was adopted for some years, but when she was about 13 she spent two weeks with her own family and after that Helen usually came and stayed with her for a while twice a year.

EVIDENCE FOR MONOZYGOTIC ORIGIN OF THE TWINS

Here again the available evidence bearing on the zygotic origin of the twins G and H, given in Table 8, suggests that they are monozygotic.

ENVIRONMENTAL SURROUNDINGS AND HISTORY

Community. The twins were brought up in the same part of the country, a very remote district in the Northwest. Both lived on farms during childhood.

The homes. Gertrude was brought up as an only child. Her foster father was Finnish, the foster mother Danish. According to her daughter, Gertrude was warmly cared for during her early child-

hood, provided with suitable clothes, and presented with gifts on holidays. When she was nine her foster mother died, and after that she kept house for her foster father. Gertrude's account indicates a consistently good relationship with her foster father even though he sometimes indulged in heavy drinking bouts, especially on his occasional trips to town. He did the cooking, but she had many farm chores. She played largely by herself or with the children of the family across the river, with whom she went berry picking and swimming. She remembered that they had frequent fights, but did not remember what they were about. After her marriage her foster father lived alone, on an inland ranch, but when he became feeble and childish, her husband persuaded him to come and live with them where Gertrude could care for him. He lived to be 96 years old.

There is little information about Helen's childhood with her own parents. She was not given chores to do, and did not remember having had home training of any sort. Apparently the children were just left alone. They were never punished. The father and maternal grandmother who lived with them were inclined to be mean and hard to get along with. There were no holiday celebrations except rice pudding at Christmas.

Education. Neither girl had much schooling. Both attended the county school for a few months a year, and Gertrude once went to a boarding school for nine months, but she did not finish the seventh grade and Helen stopped before the fifth grade.

Occupational history. Before her mar-

TABLE 8
PHYSICAL CRITERIA OF ZYGOTIC ORIGIN
TWINS GERTRUDE AND HELEN

Age 52	Twin G		Twin H	
Height (stocking feet)	161.1 cm.		161.4 cm.	
Head breadth	16.4 cm.		15.7 cm.	
Head length	19.4 cm.		17.7 cm.	
Cephalic index	84		88	
Head circumference	23.0 inches		21.5 inches	
Interpupillary distance				
Left reading	6.55 cm.		6.62 cm.	
Right reading	6.6 cm.		5.95 cm.	
Eye color (Martin chart)	3 Brown flecks around center, bluer		3 Rim wider	
Need for glasses	Reading		Reading	
Hair:				
Color	Brown and gray		More gray	
Form	Straight		Straight	
Texture	Coarse		Less coarse	
Thickness	Thick		Less thick	
Medullation	75%		75%	
Type	Discontinuous		Same but islands not so heavy and more dispersed	
Pigment granule pattern			Same	
Average diameter shafts	85 microns		78 microns	
Cortical fusi	Normal, but interspersed with irregular ones (due to waving?)		Normal, few in number	
Cutical scales			Same	
Skin color:	Light		Light	
Freckles	A few on forehead		Same	
Oral cavity:				
Teeth color	Yellow		Yellow	
Condition of gums	Reddish		Same	
Tongue furrows	None		None	
Feet:				
Size of shoe	6E or EEE		6 less wide	
Hands:				
Mid-digital hair	L4 RO		L4 R4	
Downy hair:				
Face	Light over lips and chin		Same	
Arms	Light		Same	
Handedness	Right		Right	
Fingerprints				
Thumb	R W 23-30		R W 21-?	
Index	L W 15-17		L W 21-22	
Middle	L L ^u 15		L L ^u 15	
Ring	W 29-19		W 27-26	
Little	L ^u 18		L ^u 25	
Total ridge count	166		165*	
	L L ^u 16 W 23-12 W 17-20 W 20-25 L ^u 20?		L L ^u 13 W 30-15 W 25*-19 W 13-25 L ^u 23 163*	

* Estimated.

riage, Gertrude worked only on her foster father's farm and after marriage she had occasionally done similar work; for example, she and Helen picked hops one summer. At the time of the study Gertrude ran a rooming house and grocery store on the water front of a small town.

Helen did outdoor work on farms before her marriage, and enjoyed it. After her marriage, she occasionally sewed for others. This had not brought in much income, however, because she enjoyed making clothes for little girls so much that she would charge almost nothing for it. (She had only boys of her own and always wanted girls.)

Health history. As has been noted, both were very small at birth, about three pounds in weight. At the time of the study both were very much overweight; one weighed 236 and one 222 pounds. Each had been small until she began having children, but gained with each child and never lost thereafter. During childhood both had measles and mumps, but no other diseases which they remembered, and their health and general energy were excellent. After they became adult, both had severe cases of yellow jaundice at the same time, although they were then living some distance apart and had not seen each other for two years. Hearing was fair; both wore reading glasses. Age at menopause was early for both, for Gertrude 36, for Helen 34.

The health of both remained generally excellent until each developed rheumatism. When Gertrude was 47, she spent almost a month in the hospital with rheumatism, but her condition improved after she went to a hot springs, except for periodic swelling of the ankles. At 51, Helen spent about two months in the hospital with the same difficulty, and never was really well after that. She was

unable to walk for a long time, and a year later went again to the hospital with a heart disturbance. She died there from dropsy, a few months after Dr. Burks' visit.

SITUATION AT TIME OF STUDY (1942)

The twins were 52 years of age at the time of the study. After going around with a number of boys, Gertrude at 22 married a man much older than herself, who had much the same drinking pattern as that shown by her foster father. They lived on a ranch for some years and after that lived in a succession of small towns. There were three children: a daughter and two sons. Both boys died of flu and the daughter became blind at that same time, at the age of six. Gertrude's daughter said that when she was young the children had to do as they were told or they were whipped. But they were taught to be sympathetic, and if they slapped an animal, Gertrude slapped them. Gertrude's daughter did not confide in her mother at any time. At the time of the study, G was living in a small town in the Northwest, where she ran a rooming house and grocery store, as has been mentioned. She did not like the community in which she lived and did not engage in an active social life. She belonged to a card club and occasionally went to the movies and read a few "pulp." She rarely went to church. Her daughter was married and had a child of her own at this time. They lived nearby, and G spent a good deal of her time with them. G's emotional tone was far from cheerful. She said, "I don't see why we're put in this world, no pleasure, but as long as we're here, make the best of it. . . . We [the triplets] should never have been born."

Helen married at 20 the first man she

had ever gone with and had ten children, of whom six sons survived. Her marital relations were somewhat happier and more affectionate than Gertrude's. Helen's niece said that she seldom punished the children, but she would sometimes go off on trips and leave them to fend for themselves and habitually left them to cook and wash for themselves. Her husband put it that she "tried never to interfere" with the children. All had seventh or eighth grade education, one attended high school. The youngest son played truant from school and finally was sent to a training school. Helen and her husband always had difficulty getting along financially, although both were hard working. They always had good relations with their neighbors and Helen had many friends. The family went to church occasionally, and Helen belonged to three organizations, although she was never an officer in any of them. She was fond of embroidery and sewing, and liked to listen to the radio, but she read only local news, never books nor magazines. At the time of the study H was in a hospital about 80 miles away from her home. In spite of this distance, however, her many friends did not neglect her, and she had visitors every day.

TESTS, RATINGS, AND OBSERVATIONS

Intelligence tests. On the Kuhlmann-Stanford G did somewhat the better of the two. Her Mental Age was 10 years, 6 months, her I.Q. 66, but her performance was erratic and her scatter very wide. Her basal year was 6. She failed at 7 years Digits forward, at 9 years Comprehension (but passed it at 10), Making change, and Rhymes, at 10 years Digits forward. She passed, however, at the 12 year level Abstract Words, Digits backward and Pictures, and at 14 years the

Induction test. Vocabulary was at the 10 year level. The irregularities in her performance in repeating digits were striking: she was able to repeat 5 Digits backward but only 4 Digits forward.

H was ill at the time the test was given, shortly before her death. Dr. Burks noted that her attention was good and that she did not seem fatigued during the test, but was too tired to continue the interview afterward. Her basal year was 7. She failed the Ball-and-field, Comprehension, and Definitions at 8 years, Words and Rhymes at 9 years, and all of the 10 year tests. Vocabulary score was 23 words; she repeated 5 Digits forward (6 were not tried apparently) and 4 backward. Her Mental Age was 8 years, 2 months, her I.Q. 51.

Descriptive rating scale. On the descriptive rating scale filled out by Dr. Burks, the sisters received the same ratings on 10 out of the 12 items. On two they differed: Helen was rated as "quite masculine," her sister as "neither masculine nor feminine," and Dr. Burks added on Helen's record, "Speech profane, briefer, more clipped than Gertrude's. Similar in body handling." On cheerfulness, Helen was rated 4, rather sombre, pessimistic, and Gertrude 3, neither sombre nor gay, but with the note that Helen's hospital situation should be considered, and that she laughed occasionally and suddenly just as her sister did.

In the light of the earlier quotation of Gertrude's and the somewhat dreary mood suggested by it, a similar rating of 4, "sombre, pessimistic" for both twins would seem to have been justified.

Trait ratings. Ratings on physical and sensory traits are shown in Table 9. Ratings were made by Gertrude's daughter for both G and H and by Helen's husband for as many traits as he felt able to

TABLE 9
 TRAIT RATINGS OF TWINS GERTRUDE AND HELEN
 MADE BY GERTRUDE'S DAUGHTER AND HELEN'S HUSBAND

Trait	Rater	Degree				
		1	2	3	4	5
General health (until recently)	G's daughter H's husband	G H				
Physical energy (when young)	G's daughter H's husband	G H				G H now
Amount of activity	G's daughter H's husband	G H†				
Appetite	G's daughter H's husband	H	G G H			
Sleep depth	G's daughter H's husband					G H† G H
Reaction to pain*	G's daughter H's husband					G H† G H
Sympathy for family	G's daughter H's husband		G		H	
Sympathy for friends	G's daughter H's husband		G H			
Perseverance	G's daughter H's husband		H†	G†		
Self-assertion	G's daughter H's husband			G H G H		
Talkativeness	G's daughter H's husband				G H	
Promptness	G's daughter H's husband		G	G†	H	H
Speed of decision	G's daughter H's husband			G		
Jealousy	G's daughter H's husband		H	G H		
Generosity	G's daughter H's husband		G	H G H		
Self-consciousness	G's daughter H's husband		G H			
Competitiveness	G's daughter H's husband	G			H	
Sense of responsibility	G's daughter H's husband	G			H	
Sense of humor	G's daughter H's husband		G H		G H	

* G's daughter notes, "Both hurt so easy, if you touch them, scream. Arms bruise easily but scratches don't react. Both rave if sick and in pain."

† Ratings made on basis of Dr. Burks' notes.

TABLE 9—(continued)

Trait	Rater	Degree				
		1	2	3	4	5
Irritability	G's daughter H's husband		G	G H	H	
Cheerfulness	G's daughter H's husband			G H G H		
Courage (physical)	G's daughter H's husband				G H	G H
Courage (moral)	G's daughter H's husband	G H G H				
Facing facts	G's daughter H's husband		G H	H†	G†	
Trustfulness	G's daughter H's husband	G H G H				
Sociality	G's daughter H's husband			G G H	H	
Leadership	G's daughter H's husband			G		H H
Popularity	G's daughter H's husband	H		G	H	
Emotional depend- ence on family	G's daughter H's husband			G H		

rate. According to G's daughter, who rated both twins on 28 items, they were alike in 16 traits; she rated them as different by one step in 6 traits, by two steps in 4, and by three steps in 2 traits. H's husband, rating them both on 15 items, rated them the same in 14 traits and different in 1. The only marked discrepancy in ratings by the two was for H's popularity, which her husband rated as 1 and her niece (i.e. Gertrude's daughter) as 4. It was apparent that H's niece did not approve of her and this attitude was probably reflected in the ratings.

Rorschach test. The Rorschach protocols are given in Table 10. The tests were administered by Dr. Burks. An Inquiry is recorded for G's test but only a brief one for H's.

Dr. Davidson's comments on G's Rorschach were: "Insecure; deteriorated; poor adjustment." On H's test she comments: "Sick, inadequate personality; deteriorated; very poor adjustment." Dr. Valentine agrees and in addition submits an approximate psychogram, given in Appendix E, and makes the following comments:

"So far as their Rorschach protocols are concerned, these would indicate that both twins G and H are sadly impaired in functioning. Whether their poor performances are the result of deterioration or an indication of a life-long poor adjustment and level of functioning it would be hazardous to guess on the basis of these records. Those responses which are poor Form are not bizarre but rather vague anatomy perseverations. Once started, it is easier so to continue than for them to exert themselves to see anything else.

"There are similarities in the two psychograms: below average number of responses;

TABLE 10
RORSCHACH PROTOCOLS
TWINS GERTRUDE AND HELEN

Twin G	Twin H
I. (8 ⁿ) Might be a skeleton of bug or bat, isn't that right? That's what I think it would be (cautious). No. 1 $\frac{3}{4}$ min.	I. (2 ⁿ) Butterfly, isn't it? (turns). Kind of man's picture face. 1 min.
II. \surd (15 ⁿ) I don't know what that would be. Might be a backbone or something, would it? I don't know what it would be. It might be a giant or something with backbone. 2 $\frac{1}{4}$ min.	II. (3 ⁿ) Man's front breast through here, and neck. (no time)
III. (10 ⁿ) I don't know. \surd What is it supposed to be? a drawing? Might be a stone image or anything living? I don't know what it would be; might it be part of a person's body? I don't know what it would be. 3 min.	III. (6 ⁿ) Some kind of people's body I think. $\frac{1}{2}$ min.
IV. (15 ⁿ) Might be a skeleton of sea fish or something. That's what it looks like to me. $\frac{3}{4}$ min.	IV. (12 ⁿ) I don't know, that's just a shoulder or something, some kind of body like a rabbit, isn't it? \surd $\frac{3}{4}$ min.
V. (5 ⁿ) A bat (laughs) I'd say more like a bat than anything I could figure out. Is this to try your eyesight? 1 $\frac{1}{2}$ min.	V. (6 ⁿ) I don't know. \surd/\wedge (30 ⁿ) . . . unless across the spine here. (no time)
VI. (8 ⁿ) Cow hide (laughs, then giggles loudly). I don't know if that's what it's supposed to be. 1 min.	VI. (10 ⁿ) All people's bodies or what? Like the backbone I guess, looks something like it. $\frac{3}{4}$ min.
VII. (8 ⁿ) Goodness, I'd say cloud or something in the sky, you see clouds sometimes, funny shapes. They don't represent anything do they? 1 $\frac{1}{2}$ min.	VII. (10 ⁿ) I don't know. Looks like some (30 ⁿ) kind of meat (laughs). I don't know at all. It's something. Some kind of flesh I guess. (no time)
VIII. (10 ⁿ) I don't know what that would be. Another one of them things, I don't know what it would be. I don't know. $\frac{3}{4}$ min.	VIII. (10 ⁿ) A little bit like a chest. Little ribs a-sticking here. Looks pretty much like it. $\frac{1}{4}$ min.
IX. (25 ⁿ) I don't know either. It wouldn't supposed to be a person's lungs would it? I don't see that it would be anything. Sort of funny things. 1 $\frac{1}{2}$ min.	IX. (12 ⁿ) I guess some part of human's body. $>\surd$. . . What did G call them? (no time)
X. (25 ⁿ) In a way it sort of looks like a person's system all inflamed. I bet I don't get any of them right. 1 min.	X. (10 ⁿ) Looks like a person's neck (top gray). Some kind of person. $\frac{3}{4}$ min.

TABLE 10—(continued)

Twin G	Twin H
INQUIRY	
I. Whole.	I. Butterfly: whole. Man's face: side edge Dd profile.
II. "Middle is where spine would go (space), the red ones where nerves would come."	II. Breast: upper part of black. Adds: neck is red (top).
III. Image: man's torso; stone: usual leg; "are red splotches supposed to be blood or what?"	X. Neck: center stalk of top gray points out pink as ribs side blue as shoulder, lower green as spine.
IV. Whole. "So many jellyfish when they dry up, kind of like that."	
V. Whole.	
VI. Whole. "If I'd know what it was I could see something else."	
VII. Whole. "Just the way they come up over mountain or in sky some times, funny shapes."	
VIII. "It doesn't look like anything. No. It might be a couple of bears climbing somewhere . . . 4 legs."	
IX. Lungs: "I imagine that's the way they'd look if they'd be inflamed or anything like that."	

percentage of anatomical responses greater than animal responses; percentage of good Form responses below normal; Popular responses below normal (only 1 in the case of H); the majority of their perceptions are poor and vague Whole responses.

"Differences are that G's percentage of good Form responses is somewhat higher than H's; G has more Popular responses, and a lower percentage of responses with anatomical content.

"In protocols such as these the lack of a thorough Inquiry prevents more than the briefest and most tentative observations. However, G seems to be capable of a slightly more adequate adjustment than H; she has somewhat more awareness of and conformity with accepted social conventions; she is less concerned with her body and its functioning, whereas H is very much preoccupied with this. G seems more capable of emotional interplay with others, although always with egocentric emphasis."

Handwriting. Samples of their handwriting are given in Figures 4a and 4b. Helen was ill at the time, but even so the similarity is very apparent.

SUMMARY

The twins Gertrude and Helen, two survivors of triplets born to Finnish immigrants, were separated at about one year of age. Gertrude (Twin G) was taken by foster parents, while Helen (Twin H) remained in her own home. Both were raised on farms in the Northwest.

The chief environmental difference was the warmth with which G was surrounded in her relations with her foster mother, and after her foster mother's death with her foster father. H on the other hand was brought up in a hit-or-miss fashion, with little of tenderness, ease, or discipline. Neither twin had much schooling. Both had done farm work occasionally before their marriage.

The developmental histories had strik-

Four Score and seven years ago our Fathers
brought forth upon this continent a new nation
conceived in liberty and dedicated to the
Proposition that all men are created equal.

FIG. 4a. Handwriting. Gertrude.
Time: 3' 40".

Four score and seven years ago our father brought forth
upon this continent a new nation conceived

FIG. 4b. Handwriting. Helen
Time: 5' 15".

Note by Dr. Burks: Letters were painstakingly drawn; seemed fatigued, so Ex. told her the first two lines would be enough of a sample. She said it made her nervous to write with pen, she was only used to pencil. She was ill at this time.

ing similarities. Each weighed only three pounds at birth. At the time of the study, at the age of 52, both were greatly overweight, having gained at time of child-birth. Both reported measles and mumps in childhood and severe yellow jaundice in adulthood. Both reached menopause at an early age. Both suffered from acute rheumatic conditions. At the time of the study both twins were married and G had borne three children (one living), H ten (six living).

On the intelligence test, administered at the time of the study, G's performance was better than H's. But H was then ill and died of dropsy shortly thereafter. The difference in Mental Age could be attributed largely to this circumstance. Ratings both on characteristics that could be observed during the interview and on physical and sensory traits were markedly similar, as were the Rorschach records and handwriting samples of these twins.

CHAPTER V

TWINS JAMES AND KEITH

THE TWIN boys James and Keith were born in 1933, the illegitimate children of American-born Lithuanian parents. The putative father had been a boxer and farm worker, and was said to be friendly and kind. The mother had worked as domestic and nursemaid, after two years in high school. She was described as honest, dependable, good-natured and even-tempered, but "man crazy." She is said to have had later another illegitimate child. She was committed to a training school for girls, where her Stanford-Binet Mental Age is given as 13 years; Pintner-Paterson 14 years, 6 months; Porteus Maze 17 years; and Healy II 18 years, 8 months.

The twins did not remain with her for any length of time. For the first ten months of their lives the babies were placed in various boarding homes, under the supervision of the Department of Public Welfare. At one of these boarding homes records were kept of the birth weights and of certain other measurements and notations made at one year of

age. These data are given in Table 11 and may be compared for the two boys.

The similarities are striking. The general condition of both was said to be "fair." A note to "watch James' right knee," however, indicates that there was already evidence of the condition which at 14 months was diagnosed as tuberculosis of the knee. This necessitated placing James in the hospital of an orphanage, where he was living at the time of the study. Keith continued to be placed in various homes until finally at the age of five or six he was adopted.

EVIDENCE FOR MONOZYGOTIC ORIGIN OF THE TWINS

Available data bearing on the zygotic origin of the twins are given in Table 12. In the records of the adoption agency is the statement of a physician, who had been present at the birth of the children, that they were not identical twins. This note was dated two years after the birth of the twins, and the basis for this opinion was not given nor was it possi-

TABLE 11
PHYSICAL MEASUREMENTS AND OBSERVATIONS ON
TWINS JAMES AND KEITH AT ONE YEAR

	Twin J	Twin K
Birth weight	4 lbs.	3 lbs.
Present weight	16½ lbs.	16½ lbs.
Height	28 inches	27½ inches
Chest		
insp.	17¼	17½
exp.	16	16¼
	Sleeps well	Poor sleeper
	Some constipation	Constipated
	Two teeth	No teeth
	Face seems fuller, larger	Sweet mouth and dimple in chin

Both have light hair, very little, inclined to be sandy; look much alike; well shaped heads; nice blue eyes; Wassermanns are negative.

TABLE 12
PHYSICAL CRITERIA OF ZYGOTIC ORIGIN
TWINS JAMES AND KEITH

Age 7 Years	Twin J		Twin K	
Hair:			More shafts medullated	
Medullation	Discontinuous		Discontinuous	
Type				
Pigment granule pattern	Same			
Average diameter shaft	80 microns		70 microns	
Cuticular scales	Same			
Cortical fusi	Very few and small			
Fingerprints:	R	L	R	L
Thumb	W 25-17	L ^u 22	L ^u 23	L ^u 17
Index	W 7-8	W 8-8	A ^t 0	L ^u 16
Middle	L ^u 9	L ^u 8	L ^u 8	L ^u 1
Ring	W 27-7	W 2-27	L ^u 4	L ^u 8
Little	L ^u 24	L ^u 21	L ^u 8	L ^u 11
Total ridge counts	124	96	43	53
Diff. in ridge counts:				
bilateral, 36				
homolateral, 12				
heterolateral, 118				

ble to obtain any additional information from the physician. Dr. D. C. Rife, on the basis of the fingerprints, also felt that these twins were probably not monozygotic, though he did not consider the evidence sufficient to rule out the possibility. Dr. Burks herself believed that this pair, as well as the other three pairs, were monozygotic.

SITUATION AT TIME OF STUDY (1940)

Until the age of eight, James remained in the orphanage hospital to which he had been sent at 14 months. After this he was placed in a foster home. (Dr. Burks' study occurred just before this placement.) Life at the hospital was highly institutionalized, and much of the routine was designed for the convenience of those in charge rather than for the better development of the children. The lack of stimulation to learning in the environment may account for James' backwardness in such matters as speech, self-care, dressing and bathing, assumption of responsibility, etc. He was not

without affection, however, as the Sister in charge of him when he was a baby gave him a good deal of personal affection, and he continued to visit her daily even after he was moved to the Boys' House. These visits were apparently made possible only by the fact that he had to report to the hospital daily to have his knee cared for, since generally there was no provision whatever for individual recognition of the children.

Keith on the other hand was the only child in his foster family and was apparently treated affectionately. He was able to dress himself; his foster mother reported that he could bathe himself but that his father liked to do it. He lived in a moderate-sized Eastern city, where he was kept fairly closely at home, except when his parents were with him. They took him out a good deal, though, for fishing and swimming, and he enjoyed "helping" his father with carpentry about the house.

School record. In their first year at school neither boy did very well, but

Keith improved considerably in the second term. Teachers of both boys, as well as all other adults who came into contact with them, noted that their attention-span was very much less than normal, which of course would retard learning.

Association with other children. Although both boys were described as always cheerful and happy, and seldom resentful, neither got along well with other children. James' teacher reported that he had no sense of responsibility, forgot to do things he was told, and often did things very impulsively without waiting to see how they should be done. He often hit other children without any particular reason, or tripped them up.

Keith's teacher noted: "He is constantly in trouble on the playground, quarrels with the children, is very mean to them and often vicious in that he throws things that hurt them badly. He is also very underhanded and sly about doing things and trying to shift the blame on other children. He is very unruly." His foster mother, however, found him very appreciative, affectionate, and helpful.

James' irresponsible behavior might be due to considerable insecurity, of which there is other evidence. He was at the time of the study very much preoccupied with his status as an orphan, and apparently fantasied very extensively about his mother. Keith's foster home situation would be expected to have given him increasing security, and it is possible that his aggressive behavior toward other children was a temporary carry-over from an earlier period.

Health history. James had always had trouble with his tuberculous right knee. In addition he had had measles, mumps,

and chicken pox, and at five and seven recurrent ear infections. At the time of the study his hearing was definitely defective.

Data on Keith's health history are lacking.

TESTS, RATINGS, AND OBSERVATIONS

Intelligence tests. Dr. Burks gave James the 1916 form of the Stanford-Binet test when he was 7 years and 2 months old. He attained a Mental Age of 5 years, 3 months, an I.Q. of 73. She noted: "The I.Q. alone would suggest borderline deficiency, but the wide scatter suggests the influence of emotional blocking or specific limitations of experience or both. Moreover, James has learned to read this winter, an attainment seldom reached under a Mental Age of 6 or 6½. In view of an earlier reported I.Q. of 96 at 4 years, 4 months, he might be expected to come up to low average range if he could have the individual care of a boarding home. It is possible that poor hearing also accounts in part for the low level of functioning and for his indistinct infantile speech, which is not due to any impediment as far as can be judged."

Dr. Burks did not test Keith, but the record shows that Stanford-Binet tests on various occasions gave the following results: at 4 years, 1 month, an I.Q. of 86; at 5 years, 1 month an I.Q. of 95; and at 6 years, 6 months, an I.Q. of 91.

Goodenough Nonverbal Test. The drawings reproduced in Figures 5a and 5b were obtained by Dr. Burks when the twins were 6 years, 9 months old. James scored a Mental Age of 5 years, an I.Q. of 74, and Keith a Mental Age of 7 years, 6 months, an I.Q. of 111. About six months later, their scores were 5 years, 9 months and 7 years, 3 months.

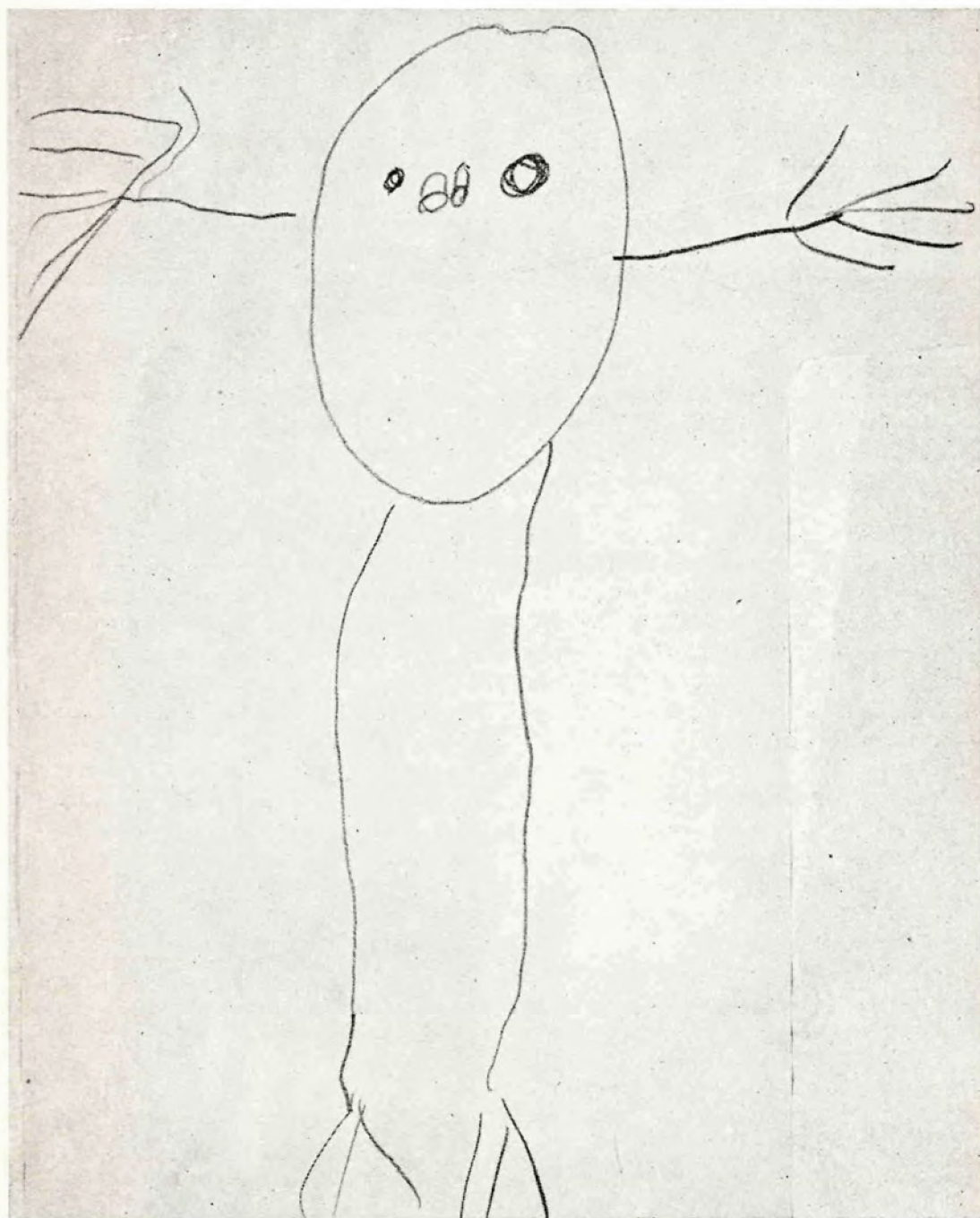


FIG. 5a. Drawing by James.
C.A.6-9; M.A. 5-0; I.Q. 74.

TABLE 13
VINELAND SOCIAL MATURITY SCALE
TWINNAMES JAMES AND KEITH

	Twin J	Twin K
III to IV Years		
<i>Item</i>		
45. Walks downstairs 1 step per tread	Plus	
46. Plays cooperatively at kindergarten level		
47. Buttons coat or dress	Plus Minus	Plus
48. Helps at little household tasks	None	Plus
49. "Performs" for others		Plus
50. Washes hands unaided	Plus	Plus
IV to V Years		
51. Cares for self at toilet	Plus	Plus
52. Washes face unassisted	Plus	Plus
53. Goes about neighborhood unattended	No chance	Minus
54. Dresses self except tying	Plus Minus	Plus
55. Uses pencil or crayon for drawing	Plus	Plus
65. Goes to bed unassisted	Plus	

In the drawings reproduced here and in others in the record, the animation in Keith's is quite extraordinary.

Vineland Social Maturity Scale. Results for the two boys at 6 years, 9 months are given in Table 13. Omitted items were failed by both, or not scored. It is clear that Keith was ahead of James in this measure of maturity. Undoubtedly some of the difference reflects differences in opportunity to learn.

Dramatic play with toys. The dramatic play situation was developed as follows:



FIG. 5b. Drawing by Keith.
C.A.6-9; M.A. 7-6; I.Q. 111.

Metal toys, representing people, animals, furniture, and vehicles adaptable for imaginative play, were wrapped separately in paper and then placed on a desk in front of the children. Notes taken by Dr. Burks, the examiner, (*Ex.*) described the child's reactions to each toy, including a verbatim account of his remarks. The striking differences in spontaneity between the two boys is evident from their records which are reproduced below in full.

Twin J

The toys were placed on the desk before J, who enjoyed unwrapping them but showed no interest in examining them further. In order to stimulate further reaction the examiner sought to focus his attention upon each toy as it was unwrapped with such questions as: "What is this?" "What is it for?" or "What does it do?"

- (Red car)
A car. For play with.
- (Cowboy and pony)
He rides.
He wrestles with somebody.
- (Airplane)
An airplane.
Ride up in the sky.
- (Traffic policeman)
A soldier.
Ex: What does he do?
He's marching.

- Ex:* Do you think it is a policeman?
 Yes. He's doing this (gesture with hand).
Ex: What does he tell people?
 He's doing this.
5. (Old man)
 A man's got a cane.
Ex: Is he a young man?
 Yes.
6. (Motor policeman)
 A cop on a motorcycle.
Ex: Where is he going?
 To his house.
7. (Man with coat over arm)
 He's holding a coat.
Ex: Who is?
 A man.
8. (Woman with tennis racket)
 She's holding a pocketbook.
Ex: Who is?
 A lady.
9. (Boy)
 A man.
Ex: Is it a man or is it a boy?
 Yes.
10. (Boy)
 They are just the same. He is holding something.
11. (Woman with dog)
 A lady with a doggie.
12. (Girl)
 A little girl with a doll.
13. (Dog)
 A little horse.
Ex: Are you sure it is a horse?
 A dog.

After all the toys had been unwrapped J lined them up in a row, dropping several as he did so. He asked about the woman figure, pointing to tennis racket, "What is that?" He then moved all the figures over in another double row naming them: two little boys, two big men, two big ladies, one little girl, a cowboy, etc. He put the girl on the car and the lady on the airplane.

Ex: What do you call this? (pointing to the propeller of the toy airplane)
 The wing.
Ex: What does it do for an airplane?
 The wing.

J now removed all of the toys except the family group of father, mother, two boys, and dog. J put the dog on the hat of the man, but showed no other initiative with the toys.

Ex then set up and described a situation. The father was going to work, the mother was going to the store, and the boys were going to school. J moved the toys appropriately but did not develop the theme.

- Ex:* Now it's time to come home, etc.
 He comes home; they come (moving toys).
Ex: What does the mother say when they come home?
 J places one boy by the father, one boy by the mother.
Ex: What do they say?
 I don't know.
 (Manipulates the toys aimlessly and then says he wants to make another picture.)
Ex then gave J paper and crayons. Using the man as a model he attempted to copy it.
- Ex:* What's this? (producing a toy bed)
 A bed.
Ex: It's a bed for the boys. What do they do?
 J piles all the toy dolls including the dog into bed, then removes them.
Ex: It's bedtime for the boys.
 J puts the boys in the bed.
Ex: Does anyone say good night to them?
 Yes.
Ex: The father?
 J brings the father doll over but does not develop the situation.

Twin K

The examiner took out the small metal toys each wrapped in a separate paper and put them on the desk for Keith to open. He enjoyed doing this and as soon as he opened one he immediately seemed to know what he wanted to do with it; arranged it in a very definite way and had it enter into the game.

1. (Red car)
 K responded immediately.
 A mail car. (In the city where K lived special deliveries were made in red cars.)
 Ran car over desk for a while.
2. (Traffic policeman)
 Soon had policeman signaling the car to stop and start.
3. (Motor policeman)
 This is a cop, too!
 Soon had the motor cop chasing the red car.
4. (Nurse)
 Oh, a nurse! We'll put her over here (puts her to one side).
 Is there a hospital here?
Ex: There probably is one in the city.
5. (Dog)
 K had dog following policeman.
6. (Woman)
 We'll have the woman walking along the street.
7. (Man)
 This is a father.
8. (Boys)
 Places one boy with mother; other going to school.

9. (Cowboy on pony)
K delighted.
I play cowboys, too!
Plays with cowboy on the pony for several minutes.
10. (Girl)
A girl. We'll have her play out in the yard.
11. (Dog)
I wonder who's going to take that dog.
12. (Man) What will I have him do? Go to work, I guess. Begins playing with the cowboy again.

K had all the metal toys arranged according to his desire and played having them cross the street, and being stopped by the policeman. He referred to the cowboy as "The Texas Ranger." He enjoyed these toys and when the examiner began to put them away, she suggested that he might like to keep the little red car as he had opened that first. With apparent pleasure, he put the car with his book. A man, a woman, and a little boy were left out and he continued to play with these. The figure of the man left out had a coat over his arm. K decided that the man, to whom he referred as father, was going to take his coat to the cleaner, and from here he went on into play, talking all the time. "The father is going to take his coat to the cleaner and the mother is going with him. She is going to buy the groceries. The boy says, 'Can I go too?' and the father says, 'Yes.' 'Can we have supper downtown, too?' 'O.K.,' says the mother. The father goes to the cleaner and the boy goes along with him while the mother says, 'I'll go buy the groceries and meet you. Where will I meet you?' 'We will meet you on the corner.'" And then K had them meet and have their supper, go to the show, and go home. At this point the bed was presented and K said, "The little boy goes to bed first and then we'll put him in the middle so he won't fall out." "Now it's morning," said K, "and the mother gets up to get the breakfast and then she calls the father to get up. The father says, 'O.K.' and he goes into the bathroom to wash. Then the mother calls the boy that breakfast is ready and he gets up and they have breakfast, and the father goes to work and the boy goes to school."

The differences in the children's behavior in the dramatic play situation are marked and demonstrate clearly the differences in their attitudes. James wanted to rush on to each new toy without an examination of the one just opened. When his attention was focused briefly by the examiner's questions, e.g., "What is it?" his paucity of ideas in relation to the toys became evident. We know that in James' institutional environment there had been little if any opportunity to play with toys of this kind, or

in general to give free expression to his imagination. Keith, on the other hand, exhibited a lively interest in the toys and reflected in his dramatization an easy identification with normal family activities.

SUMMARY

The twins James and Keith were illegitimate sons of working-class parents. At an early age, under the supervision of the Department of Public Welfare, they were placed in boarding homes. Of the four sets of twins included in this study, this is the only pair about whose monozygotic origin there seems to be some difference of opinion. The boys were first seen by Dr. Burks not long before their seventh birthday, but records covering earlier history are available from several sources. Measurements at the age of one year were very similar with respect to height, weight, and chest circumference. Both twins were described as attractive babies with nice blue eyes and well-shaped heads, looking much alike, though James' face seemed fuller. James (Twin J) had two teeth and slept well; Keith (Twin K) had no teeth and was a poor sleeper.

The most outstanding differences in the twins' first seven years are as follows: J from the age of 14 months was subjected to a highly institutionalized existence in an orphanage because of treatment needed for a tuberculous knee; had hearing impairment due to recurrent ear infections; received no individual affection except from one of the hospital nurses. K lived in boarding homes until the age of about 6, then was adopted as the only child of protective, affectionate foster parents. Both twins had difficulty at school, and were noted as having a very short attention-span, though K showed some improvement in his second term.

The records obtained at the age of

seven indicate marked similarities chiefly in the area of social behavior. Both J and K were described as cheerful and happy; they were, however, also thought not to get along well with other children, with whom they were aggressive, unruly, and lacking in a sense of responsibility.

Very pronounced at this age were the differences between the twins in mental test performance, and also in their response to a dramatic play situation. In these test situations, J's handicaps both from his history of ill health and from his circumscribed institutional existence were strongly in evidence. Dr. Burks questioned the validity of J's I.Q. of 73 and tended to attribute his low level of functioning to emotional blocking or specific limitations of experience or both. J was also noted as being backward for his age in matters of speech, dressing, assuming responsibility, etc. This again could be a reflection of the limited en-

vironment of his orphanage, where older children were assigned the job of helping to dress and bathe youngsters of J's age. James' retardation is further evidenced in his drawings and in his rating on the Vineland Maturity Scale. K's mental test performance (for which Dr. Burks obtained three earlier records) placed him well within the normal range.

In the dramatic play situation, J's inhibition and apparent blocking in relation to the development of play fantasy is in marked contrast to K's spontaneity in expressing his imaginative ideas centering around normal child life activities.

In view of the early developmental data collected by Dr. Burks, further study of these twins is much to be desired, especially after James' placement in a foster home where presumably a more stimulating environment may have helped to counteract results of the early deprivation.

CHAPTER VI

SUMMARY AND CONCLUSIONS

IT WOULD be too much to expect any far-reaching conclusions from the records available for these four twin-pairs, but the following summary on various aspects of the study may serve to highlight some of the more important findings. Table 14 gives comparative data for the four pairs of twins.

1. *The question of zygosity.* The available physical data pertaining to the zygosity of these pairs of twins have been included in the case records. There seems to be little reason to doubt the monozygosity of any of the pairs except possibly James and Keith. Dr. Burks was convinced that all were monozygotic. Dr. Leon Hausmann, who examined the hair samples, did not question the monozygosity of any set. Dr. D. C. Rife, who very kindly contributed the analysis of the fingerprints which Dr. Burks had taken, believes on the basis of the fingerprints that the first three sets reported here are identical, but questions the monozygosity of the fourth set, though he considers the evidence insufficient to rule out the possibility. The differences shown in the physical and anthropometric schedules are in the main quite small. In the case of Earl and Frank there was a difference of 24 pounds in weight and some difference in eye pigmentation, hair diameter, and dental occlusion, but differences of the magnitudes found have been noted in other studies of identical twins. In view of what is known about the difficulty of diagnosis based upon examination of fetal membranes, the opinion expressed by the physician who delivered James and Keith (that these twins were not identicals) can be disregarded.

2. *Length and completeness of separation.* The age at time of separation, although not always stated in months, seems to have been close to one year for each pair. Clara and Doris, after they were separated, had no contact with each other until the age of 30, but were in close touch for the following nine years. Earl and Frank after their separation did not meet until they were 15, but their foster families had kept in touch with each other. Gertrude and Helen had their first remembered contact at 13 and thereafter visited each other about twice a year. No mention is made of contact between James and Keith from the time they were separated at about 14 months. For the adult pairs, at least, the separation was long enough and complete enough to permit marked environmental differences to operate.

3. *The magnitude of environmental differences.* For none of the four pairs was there a very extreme difference in the cultural or social-economic level of the environments compared. The greatest difference was in the case of Earl and Frank. Earl's foster father was a college graduate and Frank's was a streetcar conductor of unstated amount of education. Earl graduated from college; Frank attended high school only six months, though later he attended night school for four years. Numerous differences less extreme have been noted in the text and in sections 7 and 8 of this summary.

4. *Differences in tested intelligence.* The Binet mental ages of the three adult pairs differed 17 months for Clara and Doris, 24 months for Earl and Frank, and 28 months for Gertrude and Helen. The respective I.Q. differences are about 10,

TABLE 14
COMPARATIVE DATA FOR FOUR PAIRS OF TWINS

Twins	C	D	E	F	G	H	J	K
Age when tested	39	39	37	37	52	52	4-4	6-6
M.A. (Stanford-Binet)	11-2	9-9 ^a	15-4	13-4	10-6	8-2 ^a	5-3 ^b	5-11 ^b
I.Q.	70	61	96	83	66	51	96	91
Community where reared	Urban		Urban, large		Remote rural			Moderate size Eastern city
Home: Child	Moderate size	Large Eastern	West Coast	Middle West	Own parents, 2 other children; neglected		Orphanage until after study	Boarding homes; later, only child with protective foster parents
Adult	Only child in foster home; cherished	2 other children in foster home; maltreated	Only child in foster home; well treated; financially secure	Only child in foster home; strong bond with foster mother; financially pressed	Drinking husband, 3 children	Fairly stable marriage, 10 children		
Education	Stable marriage, 4 children	Shell-shocked husband, 3 children	Successful marriage, no children	Warm marriages, 1 child	Intermittent	Intermittent	2nd grade orphanage	2nd grade
Health	5th grade D taught C to write	Intermittent, barely literate	College graduate	9th grade, night school	6th grade	4th grade	Short attention span	
Behavior	Similar in childhood; sties, eczema, loss of voice, eye strain, etc.	Similar in childhood; sties, eczema, loss of voice, eye strain, etc.	Similar good health; childhood diseases; hearing and eyesight good	Similar good health; childhood diseases; hearing and eyesight good	Very similar; severe jaundice, rheumatism at same time, extreme obesity.		Tuberculous knee, recurrent ear infections, hearing defective	
Miscellaneous	Many operations; diagnosed psychotic	Many operations; diagnosed psychotic	Reserved	Less reserved	Neither gay nor sombre	More sombre	Similarly unruly, irresponsible, aggressive toward other children ^c	
	Extremely talkative	Slightly less talkative	Moderately sociable	Very sociable	Fairly prompt	Less prompt	Dramatic play inhibited	
	Cheerful	More sombre	Not trustful	Trustful	Speech more extensive	Speech more clipped, profane	Dramatic play in-hibited	
	Spontaneous	No inhibitions	Defensive regarding unfulfilled ambitions ^c	Content with mod-est status ^c	Similar in body handling, sudden laughter	occasional	Dramatic play in-hibited	
	Self-controlled	Easily upset	Similar in energy, sympathy, cheerfulness, popularity, etc.	Similar in energy, sympathy, cheerful-ness, popularity, etc.	Rorschach indicates similar poor ad-justment, possible deterioration		Dramatic play in-hibited	
	Sociable	Less sociable	Vocational interest ratings notably sim-ilar	Vocational interest ratings notably sim-ilar			Dramatic play in-hibited	
	Similar in sympathy, sleeping lightly, frankness, neatness, alertness, etc.	Similar in sympathy, sleeping lightly, frankness, neatness, alertness, etc.					Dramatic play in-hibited	
	Rorschach indicates disturbance	Rorschach indicates less disturbance					Dramatic play in-hibited	

^a Probably invalid.
^b The Goodenough test, given to J and K at the age of 6-9, yielded I.Q.'s of 74 and 111, respectively.
^c Not rated on scale.

13, and 15 points. The differences between Clara and Doris and between Gertrude and Helen may be largely spurious; Doris was tested when she was recovering from a second stroke, and Helen was tested shortly before her death from dropsy. The I.Q. difference of some 13 points between Earl and Frank in all probability reflects the difference in the cultural level of their foster homes and in the amount of schooling they had had. The I.Q. difference between James and Keith varies considerably from test to test. There was some reason to question the validity of J's I.Q. at the time he was studied.

5. *School records.* Although no achievement tests were administered to any of the subjects, it is evident from the records that only Earl and Frank made anything like normal school progress. We have noted above that E graduated from college and that F attended high school briefly and night school for four years. Both Clara and Doris attended school about six years without learning to read or write. D had a tutor for a time when she was 11 but made no progress. After leaving school she worked in educated families and learned to write by her own efforts; many years later (after age 30) she taught C to write. Neither Gertrude nor Helen had much schooling; G completed only the sixth grade and H only the fifth. James and Keith, aged 7 when they were studied, both had poor school records during the first term but K was showing some improvement in his second term.

6. *Occupational histories.* The occupational histories of the three sets of adult twins were about what one would expect in view of their school records and their cultural backgrounds. Clara worked in a factory for a time and later in a hospital; Doris looked after children, washed

bottles in a sanitarium, and had various other jobs at a similar level. Earl, after graduating from college, worked one year as a hospital orderly, owned and ran a gas station for some years, later became a salesman, and at the time of the study was manager of a fairly prosperous suburban cafe; his twin, Frank, held various jobs after leaving school at 16, a number of them as tire serviceman or garageman, and for 7 years preceding the time of the study he had been working as a laborer with a utilities company.

The twins Gertrude and Helen did only farm work prior to marriage; after marriage they both picked hops one summer and Helen worked occasionally making clothes for little girls. When they were studied Gertrude was running a rooming house and a grocery store in a small town and Helen was hospitalized with dropsy.

7. *Health histories.* The health histories of Clara and Doris are interesting because of the many similarities and many differences. Common to both were measles, mumps, tonsillectomies, growing pains, menarche at age 11, eczema, sties, visual correction, nervousness, excitability, hysterectomy, and hysterical loss of voice. In addition, C had acute bronchitis at 23, pleurisy and surgical repair of lacerations at 37, and removal of a nerve tumor on the arm at 39. D had a long history of operations and hospitalizations, including removal of adhesions at 14, laparotomy and ovariectomy at 29, fractured coccyx at 36, removal of intestinal adhesions at 38, two strokes at about 39, and hospitalization as a manic-depressive at 40. Three or four years earlier her condition had been diagnosed as "psychosis with psychopathic personality." The illnesses not common to both, though exceptionally numerous for iden-

tical twins, could probably all be accounted for in non-genetic terms if the medical records had been complete.

Earl and Frank were both exceptionally free from ill health of every kind, though Frank had experienced one attack of bronchitis.

The health histories of Gertrude and Helen were strikingly similar: both were small until first pregnancy and thereafter became more and more overweight; both had measles, mumps, and yellow jaundice (this at the same time while living apart); both reached menopause at an early age (36 and 34), and both had acute rheumatism (ages 47 and 51). The one important difference was Helen's heart condition and dropsy, from which she died.

The only significant difference in the health records of the young twins, James and Keith, was J's hospitalization from the age of 14 months to 7 or 8 years with tuberculosis of the knee. It is worth noting, however, that when they were in a boarding home at about the age of one year it was recorded that one slept well, the other poorly, and that one had two teeth, the other none.

8. *Similarities and differences in personality.* The data on personality for the three adult pairs included descriptive ratings and comments by Dr. Burks on 12 traits, ratings of each subject on 24 traits by two or more persons, and the Rorschach protocols. Less information was available for the young pair, James and Keith.

Clara and Doris were much alike in 7 of the 12 descriptive traits and markedly unlike in health, poise, and mood. In the trait ratings they were judged by both raters as markedly unlike only in health, reaction to pain, and trustfulness. Surprisingly, it was Doris who appeared

"less disturbed" as judged by the Rorschach responses; it suggests that when the test was given she was not in either phase of her manic-depressive cycle. Why Doris became insane and suffered strokes cannot be determined from the records available. It will be recalled, however, that as a child she was treated harshly and punished severely, that her marriage was less happy than Clara's, and that she had many more illnesses and surgical operations than Clara.

Earl and Frank did not differ greatly on any of the 12 descriptive traits, but on the trait ratings given by their wives it appears that Frank is the more social and outgoing in his attitudes. On the Rorschach both are judged by one Rorschach worker to be above average in intelligence (another worker questions this), and "fairly well" to "probably adequately" adjusted. "Weak ego" is also noted for both, but Earl is characterized as self-conscious and Frank as responsive. For these twins, scores on the Strong Vocational Interest Test are available. Both made scores of from A to B- for the occupations of Y.M.C.A. physical director, production manager, social-science teacher, mathematics-science teacher, policeman, office worker, and sales manager. Earl's scores were higher by two or more scale-steps for Y.M.C.A. secretary, personnel manager, and city school superintendent; Frank's were higher by two or more scale-steps for carpenter, chemist, aviator, printer, farmer, real estate salesman, and purchasing agent. The scores for occupational level and for masculinity-femininity were closely similar. Altogether, the proportion of large differences in the Strong scores was very small.

Gertrude and Helen showed no marked differences either in the descriptive or in the trait ratings. On the Ror-

schach both were judged to be "poorly adjusted"; and one Rorschach worker noted evidences of "deterioration"; Gertrude was characterized as "insecure" and Helen as "sick" and "inadequate" as to personality. (The test was given not long before Helen's death from dropsy.) Helen's marriage was happier than Gertrude's, notwithstanding the greater financial strain resulting from her much larger family.

James and Keith were not rated on personality traits, but it is noted both were described as very aggressive toward other children. Keith was a little more self sufficient in terms of the Vineland Social Maturity Scale, and in dramatic play with toys he showed far more initiative, imaginativeness, and tendency to verbalization. These differences could well have been due to James' long illness and hospitalization.

9. In conclusion it may be said that despite the fairly long-continued separation of the twin pairs, the data reviewed do not offer any very dramatic evidence of the relative influences of nature and nurture. The physical similarities are more numerous and more marked than are commonly found for fraternal twins of the same sex and thus confirm the conclusions from earlier studies regarding

the operation of genetic factors. There are several instances also of the presumptive influence of environmental factors, and these would probably have been more numerous if the intra-pair environments had differed more radically. The one difference in tested intelligence that seems clearly associated with cultural differences in the foster homes is found for Earl and Frank. The fact that Doris became a manic-depressive mental patient while her twin did not could have been the result of environmental factors. The same may be said regarding the heart condition and dropsy which Helen contracted but which her twin escaped. As both had suffered acute rheumatism, a disease which sometimes does and sometimes does not involve heart complications, it is probable that Helen's heart condition had this origin and that her dropsy was a cardiac edema. That James but not Keith contracted a tubercular infection certainly need not imply a constitutional difference. In the case of all the adult pairs there is plausible evidence of linkage between minor personality differences and intra-pair differences in experiences encountered in childhood and youth. This is especially true of Clara and Doris, and, to a lesser extent, of Gertrude and Helen.

APPENDIX A

Number
Interviewer

Name

Date

DESCRIPTIVE RATING SCALE

Based on direct observation during interview

PHYSIQUE (Body build apart from height)

1. Strikingly overweight or obese
2. Sturdy
3. Neither sturdy nor frail
4. Rather frail
5. Very frail and underweight

MANNER (Impression of masculinity-femininity)

1. Markedly masculine (direct, assertive, decisive, economy of gesture, etc.)
2. Quite masculine
3. Neither masculine nor feminine
4. Quite feminine
5. Markedly feminine (coy approach, tentative, helpless, fluttery, etc.)

EXPRESSION (Clarity)

1. Excellent vocabulary, precise meanings
2. Good and rather accurate choice of words
3. No trouble making himself understood
4. Poor use of words
5. Very confused mode of speech

TALKATIVENESS

1. Extremely talkative; hard for interviewer to find opening
2. Quite talkative; volunteers considerable information
3. Gives full verbal responses, but initiates little
4. Laconic; brief replies
5. Very inarticulate; hard for interviewer to elicit responses

NEATNESS (in dress and person)

1. Fastidious
2. Rather painstaking
3. Neat and clean
4. Careless, disorderly
5. Unkempt; shabby

COURTESY

1. Elegant
2. Attends to social forms of courtesy
3. Good manners, but no emphasis on social forms
4. Sometimes discourteous
5. Aggressively rude

ALERTNESS

1. Highly stimulated by interview; follows every point intently
2. Wide-awake, good contact with situation
3. Interest fluctuates; has to be aroused by interviewer
4. Rather abstracted and sluggish
5. Continually absorbed and preoccupied; little contact established

FRANKNESS

1. Very frank and open
2. Few topics evaded; usually quite frank
3. Frank on a few topics, evasive on others
4. Seldom speaks openly
5. Marked sense of privacy; resistance to interview

FRIENDLINESS

1. Eager to please; tries to elicit approval
2. Quite friendly; outgoing; enjoys interview
3. Neither friendly nor unfriendly
4. Shows occasional hostility toward interviewer
5. Marked hostility during interview

POISE

1. Very well-poised and calm
2. Good self-control; occasional hesitancy in speech or fidgety gesture
3. Somewhat over-active; defensive or over-anxious etc. in speech
4. Easily upset; often seems on verge of going to pieces
5. Disorganized behavior; severe agitation during considerable part of interview

CHEERFULNESS

1. Constant gaiety and over-optimism
2. Light-hearted; cheerful tone
3. Neither sombre nor gay
4. Rather sombre; pessimistic
5. Very sombre or sad; difficult to elicit smile or laugh

EMOTIONAL EXPRESSIVENESS

1. Extreme emotional expressiveness; almost no inhibition
2. Spontaneous in expression of anger, joy, desires, etc.
3. Fairly expressive, but few visible signs of excitement
4. Rather reserved; seems to avoid emotional expression, but occasionally unbends
5. Extremely reserved and inhibited

APPENDIX B

Number	Name	Date
Interviewer		
		Rated by
		Relation (Parent, Friend, etc.)

TRAIT RATING SCALE

PHYSICAL AND SENSORY TRAITS

General health: S D.*

1. Very robust
2. No general health handicaps, not affected by variations in sleep or diet
3. Good except when subjected to unusual strain
4. Requires considerable special attention
5. Health is serious problem

Physical energy: S D.

1. Abounding vitality, seldom tires
2. Large amount but sometimes "overdoes"
3. Good endurance for routine activity but soon fatigued by strenuous activity
4. Unable to carry out any strenuous activities
5. Tires at slight exertion, exhausted at end of day

Amount of activity: S D.

1. Extremely restless and fidgety, almost never still when awake
2. Decidedly restless and fidgety but has short periods of repose
3. Free from restlessness for an hour or more when absorbed in an occupation
4. Restless and fidgety only at special times (when tired, etc.)
5. Almost never restless and fidgety

Appetite: S D.

1. Comes to table ravenous, looks forward to meals
2. Excellent appetite, eats with gusto
3. Ordinary, shows mild enjoyment of food
4. Indifferent to food
5. Constant effort to get him to eat

Food preferences: S D.

Food aversions: S D.

Allergies (foods, pollen, animals, other)

Sleep (depth): S D. An hour or two after falling asleep:

1. Can be roused only with great difficulty
2. Not disturbed by ordinary activity in his room
3. Not disturbed by ordinary activity outside his closed door
4. Distant noises of household waken him
5. Wakens at slight rustle

Sleep (amount): S D. Hours

Vision: S D.

Hearing: S D.

Reaction to pain: S D.

1. Stoical even if badly hurt
2. Shows signs of distress only when badly hurt (broken bone, operation, stunning blow)
3. Shows mild signs of distress at ordinary mishaps (cut finger, hot food, etc.)
4. Reacts strongly to ordinary mishaps
5. Shows signs of distress at pin prick, light pinch, etc.

* S denotes similar; D, different.

GENERAL CHARACTERISTICS

Sympathy (for family) (for friends): S D.

1. Strongly aroused by suffering, abhors cruelty
2. Goes out of his way to help another in trouble
3. Fairly sympathetic, but easily distracted from suffering
4. Usually unmoved by the predicaments of others
5. Often enjoys the predicaments of others

Perseverance: S D.

1. Seldom abandons even a distasteful task which he feels obligated to complete
2. Works for weeks on a task which interests him
3. Works for only a few days on an interesting task
4. Seldom shows day to day continuity
5. Gives up at slightest difficulty

Self-assertion (at home) (in group): S D.

1. Eager to take charge of affairs and impose own will
2. Enjoys managing, but not against their will
3. Stands up for own desires, but does not try to manage others
4. Submissive, concedes to wishes of others
5. Extremely submissive, follows suggestions without question

Talkativeness (at home) (in group): S D.

1. Chatters almost continually
2. Very talkative, volunteers something many times a day
3. Fairly talkative, responds to overtures of others
4. Talks rather little
5. Speech has to be "dragged out of him."

Promptness: S D.

1. Likes to get things done ahead of time
2. Almost always prompt
3. Occasionally delays a little
4. Late about as often as prompt
5. Habitually tardy

Speed of decision: S D.

1. Extremely impulsive, seldom stops to think before he acts
2. Makes up his mind after brief consideration
3. Weighs various possibilities deliberately
4. Goes over and over possibilities
5. Puts off decision as long as he can

Jealousy (spouse): S D.

1. Usually pleased at interest shown in others
2. Seldom shows resentment of interest shown in others
3. Occasionally resentful if he feels left out
4. Often shows resentment of interest in others
5. Persistent and intense attitude of jealousy.

Generosity: S D.

1. Enjoys sharing or giving away possessions or money
2. Enjoys sharing only with his close associates
3. Fairly generous in small matters but hesitates to give up valued possessions
4. Rather possessive, has to be urged to share
5. Very possessive, difficult to get him to share or give

Self-consciousness: S D.

1. Extremely shy and bashful of strangers
2. Shy at first, less so after 5 or 10 minutes
3. Slightly reticent in presence of strangers

4. Responsive, no noticeable signs of self-consciousness
5. Forgets himself completely, entering into occasion

Competitiveness: S D.

1. Extremely eager to win games, unhappy when he loses
2. Very eager to win, but not discouraged by losing
3. Fairly eager to win, but enjoys the success of others
4. Indifferent to winning, cares only for fun of game
5. Prefers to play with and learn from players better than himself

Sense of responsibility: S D.

1. Eager to take responsibility and carry it to successful conclusion
2. Assumes responsibility when necessary
3. Usually responsible when impressed with importance of obligation, but lax on minor matters
4. Rather irresponsible, often forgets his obligations
5. Has to be constantly reminded to carry out his obligations

Sense of humor: S D.

1. Very quick to see the funny side of things even when the joke is on himself
2. Enjoys funny stories and episodes, less amused by jokes on himself
3. Usually sees the point of a joke
4. Often has to have funny stories explained to him
5. Serious-minded, almost nothing seems funny to him

Irritability: S D.

1. Extremely quick-tempered, often flies off the handle over small irritations
2. Loses temper easily, but not without some provocation
3. Loses temper when others deliberately annoy him
4. Will endure many annoyances without losing temper
5. Almost never loses temper

Cheerfulness: S D.

1. Prevailing mood radiant, great zest
2. Cheerful and optimistic
3. Fairly contented, rarely complains
4. Tends to be dissatisfied, often complains
5. Unhappy, wistful, or dissatisfied with life

Courage (physical): S D.

1. Extremely daring, seldom deterred by risks
2. Meets situations courageously but avoids unnecessary risks
3. Fairly courageous in ordinary situations, loses courage in danger
4. Rather timid, tends to avoid risks
5. Very timid, apprehensive of trivial risks.

Courage (moral): S D.

1. Stands up for what he believes in, regardless of consequences
2. Will suffer considerable antagonism for sake of convictions
3. Doesn't mind upholding convictions if others don't ridicule, etc.
4. Seldom upholds convictions against others who differ
5. Shrinks from having others differ with him.

Facing facts: S D.

1. Unusual capacity to accept disappointments, recognize own limitations
2. Tries to be reasonable but emotions interfere with thinking just at the start
3. Occasionally resorts to pretences, daydreams, temper, etc. to avoid unpleasant necessities
4. Marked reluctance to face unpleasant facts
5. Almost never faces unpleasant facts squarely

Trustfulness: S D.

1. Trusts other people's motives so thoroughly that others can often impose on him
2. Very trustful unless given strong cause for distrust

3. Fairly trustful, but quick to see false motives
4. Rather distrustful, has to be "shown" first
5. Misinterprets motives, looks for trouble

INTERESTS AND ATTITUDES

Sociality: S D.

1. Extremely social, wants to be with friends in nearly all leisure time
2. Very social, wants to spend much time with friends
3. Fairly social, but content with own resources
4. Rather unsocial, prefers solitary occupations
5. Very unsocial, prefers solitude and objects to spending time with others

Leadership: S D.

1. Extremely successful in getting others to follow his plans
2. Others usually welcome his suggestions
3. Others usually take the lead
4. Rarely exerts influence upon plans of associates
5. Quite lacking in leadership traits

Popularity (associates of same sex): S D.

1. Very much sought after, has many close friends
2. Often sought after, well liked by most
3. Others usually welcome his company
4. Others usually indifferent to his presence
5. Others usually manage to leave him out

Popularity (associates of opposite sex): S D.

1. Very much sought after, has many close friends
2. Often sought after, well liked by most
3. Others usually welcome his company
4. Others usually indifferent to his presence
5. Others usually manage to leave him out

Attitude toward opposite sex:

Athletic interests: S D.

1. Would rather play at outdoor games and sports than anything else
2. Very fond of athletics, often participates
3. Likes to play three or four times a month
4. Indifferent, plays only when urged
5. Dislikes athletics, avoids sports

Emotional dependence on family: S D.

1. Seems almost indifferent to sympathy, encouragement or advice
2. Not dependent, but values companionship
3. Occasionally seeks encouragement, etc.
4. Usually seeks this several times a day
5. Very dependent, feels lost when presence of family is withdrawn

Special abilities in any of the following: (Describe)

Art work
 Art appreciation
 Singing
 Playing an instrument
 Musical appreciation
 Appreciation of natural beauty
 Mechanical ability
 Dramatic art
 Literary composition
 Athletics
 Domestic Arts
 Other special abilities

APPENDIX C

Rorschach Psychograms
Twins Clara and Doris

Twin C	Twin D
R	R
RT	RT
F+ %	F+ %
F%	F%
A%	A%
P	P
W	W
W(S)	W(S)
D	D
Dd	Dd
F	F
M	M
CF	CF
F(C)	F(C)
COF	COF
A	A
Ad	Ad
A anat	Hd
Anat	Nat
Nat	Blood
Mask	
1 failure (X)	1 near failure (X)
Approach	Approach
Succession	Succession
Experience balance ...	Experience balance ...
1 or more Sum C	1 Sum C

APPENDIX D

Rorschach Psychograms

Twins Earl and Frank

Twin E		Twin F	
R	10/3	R	14/3
RT	?	RT	8'/2'
F+ %	.66	F+ %	.88
F% ₁	.60	F% ₂	.57
A% ₁	.50	A% ₂	.57
P	.2	P	.4 (plus a near P in V)
W	.10	W	.9
D	.0	D	.4
		Unknown	.1
F	.6 (2 are poor form)	F	.9 (1 is poor form)
F(C)	.1	F(C)	.2 ²
FCO	.0	FCO	.1
CF	.1	CF	.1
C/F	.2 ("arbitrary" use of color)	C/F	.0
		Unknown	.1
A	.4	A	.7
Ad	.1	Ad	.1
Anat	.3	Anat	.0
Geog	.1	Geog	.0
Nat	.1	Nat	.2
		Hd	.1
		Emblem	.1
		A scene	.1
		Scene	.1
Approach	W1	Approach	W-(D)
Succession	?	Succession	?
Experience balance	O M: 3 sum color	Experience balance	.0M(2MT): 3 Sum C (?)
		Perspective used in VI	
		Color remark in VIII	

APPENDIX E

Rorschach Psychograms
Twins Gertrude and Helen

Twin G	Twin H
R	R
RT	RT
F+ %	F+ %
F%	F%
A%	A%
Anat%	Anat%
P	P
W	W
W(S)	W(S)
D	D
Dd	Dd
S	S
Unknown	Unknown
F	F
F(C)	F(C)
FCO	FCO
CF	CF
Unknown	Unknown
A	A
Ad	Ad
Aanat	Aanat
(H)	(H)
Hd	Hd
Anat	Anat
Nat	Nat
Meat	Meat
$\bar{1}$ failure	no failure
Approach	Approach
Succession	Succession
Experience balance	Experience balance

11/2
15' / 3 1/4'
.50
.54
.18
.27
3 (plus near P in I)

12/4
4' plus/1' plus
.36
.36
.25
.50
1

.7?
.1?
.2
.0
.0
.1

.8
.0
.0
.3
.1
.0

.6 (3 are poor Form)
.1?
.1
.2 (both poor Form)
.1

.11 (7 are poor Form?)
.1?
.0
.0
.0

.1
.1
.2
.2
.0
.3
.2

.1
.1?
.0
.0
.2
.6
.0
.1

(VIII)
W-(D))
?

W-Dd
=

0 M: 2 sum color?

possible trend to confused?
0 M: 0 color

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