

THE RELATIVE POWERS OF NATURE AND NURTURE: MONOZYGOTIC TWINS

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Although the "twin method of study" provides an ideal set-up for the investigation of the problem of "nature and nurture," egregious blunders have often been made in regard to the diagnosis of monozygosity.¹ A number of writers have failed to grasp the fact that it is not easy to determine whether single sexed twins are monozygotic or dizygotic. Precisely and scientifically speaking, there is only a very high degree of *probability* that some similar-sexed twins may actually be monozygotic. This degree of probability is sometimes so high as to amount almost to certainty. As everyone knows, monozygotic twins must be of the same sex since they are "derived from a single fertilized egg-cell which later splits into two parts, each developing into a complete child."²

The hasty investigator of the problem of "nature and nurture" is all too prone to seize upon one characteristic as a "proof" of monozygosity, thus speeding up his work but also vitiating its scientific validity. If twins are born with a single chorion, it is often assumed that this "proves" that the twins are identical. The common chorion is, indeed, an indication of monozygosity. It is not, however, a proof, because it is possible for the "chorions of two germs developing close together" to

fuse.³ Thus dizygotic twins may, and sometimes do, have a common chorion. It is almost impossible to tell at the time of birth of twins whether they are "identical" (monozygotic) "because important characters have not yet developed."⁴

In point of fact, monozygotic twins, at the time of their birth, tend to be *more* different than fraternal twins, in respect to weight and length, on account of prenatal conditions. The reason for this is quite obvious. When two fetuses develop in one single chorionic sac, one is generally in a more favorable position than the other and consequently is more advanced at the time of birth. By the time the single-chorion twins have reached adolescence, the identical hereditary set, if it actually exists, will have produced two human beings so much alike, in their physical characteristics, that they will be very frequently mistaken for each other, even by close friends, at first glance. Closer observation will reveal that the color of the eyes, the implantation of the hair, form of the skull, the color and vasculature of the skin are strikingly similar.

An interesting factor has recently been introduced into the diagnosis of monozygotic twins by the use of the electroencephalograph, an apparatus designed by Berger in 1929. It had of course long been known that the brain controls the body. Berger was

¹ See H. H. Newman, *Multiple Human Births*, New York, 1941.

² A. B. Fortuyn, "Modern Research on Identical Twins," *Quarterly Review of Biology*, vol. 7, 1932, p. 298.

³ *Ibid.*, p. 300.

⁴ *Ibid.*, loc. cit.

the first to record, efficiently and precisely, the minute electric discharges occurring in brain cells, active or at rest.⁵ These tracings are known as electroencephalograms or "brain waves." By 1935 the interest of a number of scientists was aroused by the unique problem of monozygotic twins in relation to the similarity or dissimilarity of the recorded "brain waves."

In recent years electroencephalograms have been made of a large number of fraternal and identical twins. Usually, but not always, those twins previously regarded as monozygotic, on the basis of the single chorion and other factors, showed identical "brain waves" when the "E.E.G." test was administered.⁶ In the case of the XY twins, one of the pairs personally studied by the present writer, not only was there a single chorion and also, after early childhood, so marked a degree of physical resemblance that even their closest friends frequently mistook one for the other, but also a complete identity of the "brain waves" as recorded by the electroencephalograph. In such a case it is safe to assume, without violating the canons of scientific precision, that these similar sexed twins are monozygotic.

In 1938 a careful study of personality differences between monozygotic twins was published by Dr. Evelyn Troup, who selected 20 pairs of identical twins in the city of Buffalo and tested them by means of the Rorschach method. Dr. Troup, who was fully aware of the difficulty of diagnosing monozygosity, used single-sexed twins previously re-

garded as identical *only* if at least eight definite criteria of monozygosity were present. Although these criteria did not include the electroencephalographic recordings, it is fairly safe to conclude that the 20 pairs of twins selected were actually monozygotic. The results of Dr. Troup's experiment coincided very closely with the findings of the present writer. The sample is, of course, too small to warrant any definite conclusions along statistical lines. The value of her study lies in the individual case histories. An analysis of the 20 cases studied suggests the following conclusions:

(1) Owing to the genetic set-up, there is a basic physical and temperamental similarity between "identical twins."

(2) There is frequently a marked difference in personality structure even in two such "identical" human entities as monozygotic twins. This difference appears clearly when the Rorschach test is given.

(3) The popular stereotype of identical twins is usually erroneous. This stereotype represents monozygotic twins as an inseparable couple bound together by common interests and close ties of affection. Since such pairs attract attention at first glance, an undue importance attaches to them. Only two of the pairs studied by Dr. Troup corresponded to this popular stereotype. The remaining eighteen showed such wide variance in personality structure and interests that her conclusion was that "the total personality pictures of the members of each pair indicated in general no high degree of resemblance."⁷

In one of the pairs tested by the

⁵ W. G. Lennox, E. L. Gibbs and F. A. Gibbs, "The Brainwave Pattern, an Hereditary Trait. Evidence from Fourteen 'Normal' Pairs of Twins," *Journal of Heredity*, Vol. XXXVI, No. 8, August, 1945, p. 233.

⁶ *Ibid.*, p. 234.

⁷ E. Troup, "A Comparative Study by Means of the Rorschach Method of Personality Development in Twenty Pairs of Identical Twins," *Genetic Psychology Monographs*, Vol. 20, No. 4, p. 544.

Rorschach method there was not only a marked personality difference but also a strong hostility between the two members. Both the personality difference and the hostility were quite clearly the result of "nurture" rather than "nature." Although this particular case is definitely abnormal both in the statistical and the medical sense of the term, it is worth mentioning because it uncovers the problem of antagonistic monozygotic twins, a problem ignored by Newman. Furthermore, it sheds considerable light on a feature which is nearly always found in normal family life, namely, the tendency of children to compete with one another for the mother's affection.

The mother of the eleven-year-old girl twins designated as A and B in Dr. Troup's study of personality development was, in 1934, in a New York State hospital. Her case had been diagnosed as dementia praecox, paranoid type.⁸ In 1936 she was sent home, under medical supervision. The twins were living at home, together with the other seven children in the family, when Dr. Troup administered the Rorschach test. The father was regularly employed as a mechanic. Both parents were born in Hungary and had come to the United States in early childhood. The twins' mother had married at the age of seventeen. She expressed dissatisfaction with her marriage and constantly accused her husband of infidelity. During the two years of her hospitalization, the twins had been placed at first in a foster home where both made a very satisfactory adjustment. After a few months they were sent to an orphanage, where the other children had already been placed.

After the mother's release from the hospital, arrangements were made for her to visit the children. It was during this period that the differences between twin A and twin B became apparent. The Sisters reported that twin A became "jumpy" when the mother appeared. She begged to be taken home. Her school work began to deteriorate; she "withdrew into herself" and displayed symptoms which were diagnosed as possible chorea. Her request to return home was granted. Twin B remained in the orphanage for a few months longer. When both twins were home the mother reported that she had no difficulty with twin B but claimed that twin A was "nervous, had terrible dreams, and was afraid to take a bath in a tub." She quarrelled constantly with twin B and also with her younger brother. She told her mother:

"I'm the black sheep. You like [B] better."

Twin A was taken to a child guidance clinic, where the psychiatrist was impressed by her "marked feeling of inferiority, both socially and academically." His opinion was that the mother had rejected the child and tended to identify her with the mother's husband's sister who, according to the mother, was "queer" at one time. Both twins were of normal intelligence, the I.Q. tests being recorded as 101 for twin A and 107 for twin B.

The Rorschach tests administered by Dr. Troup showed a marked similarity in the temperament of twin A and twin B. There was, however, so great a difference in the emotional structure of the two girls that she concluded that this case showed "how different the quality of personality make-up in a pair of identical twins with similar basic per-

⁸ *Ibid.*, p. 497.

sonality constellations'" may become under certain circumstances.

The Rorschach tests of twin A indicated greater "sensitivity," a strong tendency to "retreat into introversion," together with a "more vital and colorful mental life" than in the case of twin B. Twin B was adjudged, on the basis of the Rorschach tests, to have "apparently succeeded in covering up the danger of the over-development of the whole inner life by an analyzing attitude."⁹ Both twins showed a tendency towards introversion. The personality differences were clearly a result of subtle environmental differences.

Less clear cut, but indicative of similar conclusions, is the case of the twin boys designated as K and L in Dr. Troup's study. Their age, at the time of the experiment, was eleven. Their parents were born in Germany. The father was regularly employed, and had five children at the time the study was made. The home was of average comfort.

Unlike some of the other twins studied by Dr. Troup, twins K and L were scarcely ever seen in each other's company. Twin K, who, according to the results of the Rorschach test, had passed beyond the pre-puberty stage and had entered "the introversion swing typical of the climax of puberty,"¹¹ spent most of his time in the home taking care of his younger sister. Twin L, on the other hand, who was aggressively friendly and sociable and assumed all responsibility for outside social contacts, spent nearly all his time with other boys of his own age. The Rorschach tests indicated in the case of twin L the "constriction typical of pre-puberty," although to a less

degree in relation to his surroundings than toward his inner life. The personality divergence, as measured by the test, was mainly a matter of difference in the "tempo of development."¹²

In the case of X and Y, one of the pairs of monozygotic boy twins studied by the present writer, an interesting phenomenon presented itself. Both twins were "incubator" babies. Y (the smaller of the pair) weighed four pounds at birth, and X five pounds. The mother developed an over-protective attitude towards Y, who was slightly handicapped by deafness. The "tempo of development" was curiously uneven in the case of X and Y. At the age of eleven, Y was unable to read or write or to "hold his own" in grade school, while X was able to proceed along normal academic lines. X was aggressively friendly outside the home, while Y showed a marked tendency to retreat into a world of phantasy.

The results of the Rorschach test administered in a child guidance clinic when X and Y were thirteen years old showed marked discrepancies in emotional adjustment. At the clinic, X was definitely more co-operative than Y, who "camouflaged" to the best of his not inconsiderable ability in this respect. On the basis of the tests, Y was adjudged to be slightly superior in regard to abstract thinking, while X was regarded as definitely superior to Y by the grade school authorities. The competition between X and Y for the affection of the mother was intense. Removed temporarily from the over-protective home atmosphere, Y responded gradually to the educational program outlined by the clinic, while X, who remained at

⁹ *Ibid.*, p. 501.

¹⁰ *Ibid.*, p. 500.

¹¹ *Ibid.*, p. 517.

¹² *Ibid.*, p. 519.

home with his older sibling, gradually abandoned his former hostile attitude towards Y, which had occasioned considerable anxiety in the home.

One of the most ambitious of the recent studies of monozygotic twins is the work of Rosanoff, Hardy and Plesset, who assembled the records of 1016 pairs of twins from child guidance clinics, correctional institutions, medical centers, state hospitals, and prisons. This work covered a period of ten years.¹³ The authors analyzed 409 cases of "twins with child behavior difficulties, juvenile delinquency, or adult criminality."¹⁴ Among the monozygotic twins, there were "concordant findings" in regard to delinquency or criminality in 86.9 percent of the cases examined and "discordant findings" in 13.1 percent. Since nearly all the monozygotic twins were raised together, the percentage of "concordant findings" fails to establish the thesis maintained by Lange, Stumpfl and others that a study of monozygotic twins with criminal records "proves" that there is a positive correlation between crime and heredity. Furthermore, even among the monozygotic twins where the "criminal findings" were "concordant," there were "quantitative and qualitative intra-pair dissimilarities."

As a study of the etiology of delinquency, crime, and behavior difficulties, Rosanoff's study of monozygotic and dizygotic twins leaves

much to be desired because of the fragmentary nature of the case histories assembled by him and his associates. Consider, for example, the history of Wendell and Donald C. These twins were born in 1907. They were adjudged to be monozygotic. The family was "highly respected in the community," the father being a practicing physician. Donald, the first born of the twins, was heavier by one pound at the time of birth. At school he was usually one year ahead of his twin brother. While Donald never "presented any behavior difficulty, delinquency or criminality,"¹⁵ his twin brother gambled, drank to excess, and occasionally used marihuana. At the age of 23 Wendell was arrested on charges of "grand theft and forgery." Released on probation after a term of imprisonment and placed in charge of his family, his later career is unknown. While this case history reveals almost complete divergence of behavior patterns in a pair of presumably monozygotic twins, it sheds little light on the "etiology" of behavior problems. In general, Rosanoff's material fails to substantiate his preliminary statement (considerably modified in his "Summary") that his "findings were roughly in harmony with those previously reported by Lange, Stumpfl and others, as suggesting that *hereditary factors play a part in the etiology of the behavior difficulties under consideration.*"¹⁶

An analysis of the recent studies of monozygotic and dizygotic twins suggests the following conclusions:

(1) The "twin method of study" provides an ideal set-up for investi-

¹³ Rosanoff, A. J., Handy, L. M. and Rosanoff, I. A., "Etiology of Epilepsy, with Special Reference to its Occurrence in Twins," *Arch. Neurol. Psychiat.*, Chicago, 1934, 31, 1165-1193. Also, "The Etiology of Mental Deficiency with Special Reference to its Occurrence in Twins," *Psychol. Monographs*, 1937, 48, No. 4.

¹⁴ Rosanoff, Handy, and Rosanoff-Plesset, "The Etiology of Child Behavior Difficulties, Juvenile Delinquency and Adult Criminality with Special Reference to their Occurrence in Twins," *Psychiatric Monographs*, No. 1., State of California Dept. of Institutions, Jan. 1941, p. 182.

¹⁵ Rosanoff et al., "The Etiology of Child Behavior Difficulties," p. 47.

¹⁶ *Ibid.*, p. 9. (Italics those of Rosanoff et al.) Cf. Stumpfl, F. *Die Ursprünge des Verbrechens, dargestellt am Lebenslauf von Zwillingen*. Leipzig, 1936.

gating the relative powers of "nature and nurture" *only* if used with sufficient scientific precision. However, many published studies have lacked this qualification and have merely supported preconceived notions of the importance of heredity or of environment.

(2) The role played by heredity has *not* been proved in behavior problems, delinquency, or crime, but there is a high degree of probability that certain organic diseases such as schizophrenia *may* be hereditary. In this latter field of study outstanding work has been done by Franz J. Kallmann in recent years.¹⁷ It can scarcely be denied that impressive evidence has been presented by Kallmann and Rudin which would seem to indicate an inherited predisposition for schizophrenia and this evidence is corroborated by such case studies of monozygotic twins as that of Gardner and

Stephens.¹⁸

(3) Even in this area, however, much scientific caution must be observed, while genetic "fatalism" is completely out of place. The *caveat* of Kallmann himself is of special significance. As he accurately observes:

"We may either render the given morbid gene less penetrant, or we may change its expression through carefully directed management of *vital environmental influences* or by methodological mobilization of constitutional resistance factors."¹⁹

(4) While no sociologist should adopt what F. J. Kallmann calls the "simple device" of denying the role played by human heredity, the importance of family environment is revealed in all careful studies of monozygotic twins.

Barrera, *Am. J. Psychiat.* 98: 4. 1942.

¹⁸ Gardner, E. J. and Stephens, F. E., Schizophrenia in Monozygotic Twins," *Journal of Heredity*, 40, p. 165. June, 1949.

¹⁹ Kallmann, F. J. "Applicability of Modern Genetic Concepts in the Management of Schizophrenia," *Journal of Heredity*, 39, Nov. 1948, p. 344. Italics those of present writer.

¹⁷ Kallmann, F. J., *The Genetics of Schizophrenia*, J. J. Augustin, New York, 1938. See also, *Am. J. Psychiat.* 103: 3. 1946, Kallmann, F. J. and