

in part equivocal and sometimes contradictory results. Besides the complexity of the problem, the delicate character of the diagnosis, and the rudimentary tools which were used, several other factors are underlying this situation:

1. Insufficient systematization of the set-up and the careless design of the investigations.
2. Lack of follow-up studies which allow to follow the phenomena in their evolution and, on each level, to take into account a series of precedents which were registered in due time. Naturally, one should herewith dispose of a systematic series of hypotheses and alternate hypotheses. Confusion between correlation and causal relationship is too frequent, due to lack of view on alternate explanation and of data on other aspects and relationships.
3. Uncertain diagnosis of zygosity; in MZ twins no attention to, nor data on, the age of the ovum at the time of cleavage.
4. Lack of consideration for antenatal and perinatal influences.
5. No attention paid to the typical circum-

stances which are linked to the twin situation, with the added possibility that differences exist between MZ and DZ twins.

All this makes it difficult to balance nature against nurture on the basis of comparison between MZ twins, DZ twins, and singletons. Interactions may also appear between the effect of twinning and other factors such as the socioeconomic circumstances. Because of these reasons, we started a new investigation which ran into great difficulties. Besides the twins, a group of matched control singletons was constituted. For the time being the follow-up study is completed up to the age of 5 years in 13 MZ and 20 DZ twin pairs (+ controls, that is to say, 99 children). For the younger-age group are the numbers already larger. The children were observed and subjected to psychological tests at the age of 6 months and of 1, 2, 3, 4, and 5 years. This interim report allows only for limited conclusions.

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## 2. Personality Development

### A TWIN STUDY OF CREATIVITY AND OF ESTHETIC AND EMOTIONAL EXPERIENCES

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A battery of tests was administered to a total sample of 61 (36 MZ and 25 DZ) same-sexed twin pairs, aged 18 to 25 years and approximately equally subdivided between male and female.

The tests included the Barron-Welsh Art Scale, the Perceptual Acuity Test, the Gottschaldt Figures, the Child Esthetic Preference Test, the M-threshold Inkblots, the Frank Drawing Completion Test, and the Gough Adjective Check List.

The variables of central interest were the perceptual and esthetic preference and expression measures. The Adjective Check

List was included as a measure of self-perception that surveys a large number of traits. Moreover, the twins were asked to go through the 300-item checklist under three different conditions: (1) describing themselves, (2) describing the cotwin as the cotwin would describe himself, and (3) guessing at what adjectives the cotwin would check under condition 2.

The results show relatively high heritability estimates for the human-empathic response to the M-threshold inkblots ( $h^2 = 0.61$  for threshold for human movement and 0.69 for volume), as well as for the Gottschaldt Figures ( $h^2 = 0.66$ ), the quality rating of productions on the Frank Drawing Completion Test ( $h^2 = 0.63$ ), and the Perceptual Acuity Test ( $h^2 = 0.55$ ).

The most important aspect of the Adjective Check List analysis is revealed in the sets of specific adjectives that show greater concordance among MZ twins, such as *artistic*, *inventive*, *dreamy*, *imaginative*, and *original*. If these are considered as a cluster, heritability estimates range from 0.60 to 0.80.

Thus, approximately two-thirds of the variance in artistic creativity may be due to genetic factors.

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## THE ROLE OF GENETIC FACTORS IN THE CHILD DRAWING BEHAVIOR

### A Preliminary Twin Study

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The Draw-A-Family Test has been administered to a sample of 59 (27 MZ and 32 DZ) same-sexed twin pairs, aged 6 to 12 years, in an effort to contribute to the assessment of the role of genetic factors in the child drawing behavior—a fairly important expression of the child personality development.

The drawings were analysed with respect to graphic-structural factors (such as line, hand pressure, area of the drawing, dimensions of the pictures, distribution, and shading) and contents (space representation and cotwin valuation). Significantly higher concordance values were found in MZ than DZ twins.

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## TWINS: RELATIONSHIPS BETWEEN CHARACTERISTIC BEHAVIORS AND MENTAL STATUS DURING INFANCY

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Ratings on Bayley's Infant Behavior Record (IBR) and mental test scores were analyzed for 60 female and 50 male infants

at 6, 12, 18, and 24 months of age. Significant relationships were found between certain behaviors and mental test scores. Composite scores were calculated for two behavioral clusters — one composed of behaviors relating to *Primary Cognition* and the other to *Extraversion* — and these composite scores were correlated with both concurrent and subsequent mental test scores. The Primary Cognition composite was strongly associated with concurrent mental test scores for both sexes and it furnished good predictive correlations with later-age scores. By contrast, the Extraversion composite was related to concurrent mental scores only for females, and it had no predictive power for later age scores.

When a zygoty analysis was performed for the behavior entering into each composite, it was found that MZ twins were more concordant than DZ twins during the first year for almost all behaviors. In the second year, however, MZ twins were more concordant only for the behaviors entering into the Primary Cognition composite. The results are discussed in terms of developmental changes in the behaviors assessed by the Infant Behavior Record, and their susceptibility to environmental influence.

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## HERITABILITY OF PERSONALITY AND BEHAVIOR PATTERNS AND THEIR CORRELATIONS WITH RISK FACTORS FOR CORONARY HEART DISEASE

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As part of the National Heart and Lung Institute multi-center study of twins, 190 twin pairs (93 MZ, 97 DZ) residing in California and aged 44-55 years were comprehensively studied for all risk factors for