Twin Studies in Behavior Genetics

TWIN STUDIES AND HUMAN BEHAVIOR

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Twin studies, when properly designed, constitute a powerful tool in partitioning genic from environmental influences upon behavior, and yet, they are rarely used by psychologists, psychiatrists, or other behavioral scientists examining normal or deviant behavior in *homo sapiens*. With the notable exceptions of schizophrenia and intelligence, human twin studies have barely been attempted. When it comes to mental changes with advancing age, for example, there are less than a handful in all the world, while we know of no efforts, other than our own, to utilize twins for the elucidation of psychobiological interactions responsible for the behavioral effects of drugs. The difficulties inherent in such studies are inadequate to explain their lack of popularity when compared to other investigative techniques, so that alternate causes must be sought. The conclusion can hardly be avoided that high among these causes rank a general unawareness of the information which can be gained from twin studies, an idea that environmental and genic factors are so intertwined as to be inseparable, a conviction that demonstrating genic influences upon any behavior render that behavior unalterable (i.e., impervious to nongenic influences) and a consequent reluctance of behavioral scientists, at least in the United States, to acknowledge the operation of genic factors among the determinants of human behavior, as distinguished from the behavior of all other animals.

The manifold uses of twin studies elaborated at this Congress make it abundantly clear that we can no longer afford to have affective rather than cognitive considerations decide the design of our research.

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1. *Cognitive Processes*

BIOLOGY OF HUMAN INTELLIGENCE

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Because intelligence has a different meaning to different people it is necessary to use an operational definition and it is referred to as a quantitated result of a specific test and expressed in IQ points.

Intelligence tests were devised to measure the normal variation in school children and to be used as a prognostic instrument. As such, they serve rather well, but it is still not known to what extent they measure genetically determined capabilities. However, as with any other phenotypical trait, it must be postulated that there are several causes of variation and one of them must ultimately depend on the individual genotype.

Intelligence distribution in the population is not normal, even though tests were designed to describe a normal distribution. It seems most reasonable to assume that intelligence is a multifactorial trait which means that polygenes, additive effects, epistasis, dominance, and a variety of environmental effects, have to be taken into consideration. When such causes of variation play upon a population of healthy individuals, one could expect a normal variation. It is, however, important to realize that this normal variation becomes disrupted by the occurrence

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of an unknown and probably quite appreciable number of lesional variates.

Lesional variates occur whenever and for whatever reason the central nervous system is damaged. If we accept the multifactorial hypothesis, this means that such variates become incapable of developing the potentialities which are inherent in their genotypes. Realizing that such damage may be genetical, as in many gene mutations or chromosomal disorders effecting mental retardation, as well as traumatic, nutritional, chemical, infectional or other, I should like to postulate that such obstacles to intellectual development — on a global scale — are far more important than the cultural, socioeconomic, educational, and psychological obstacles which usually receive most of the attention.

Although much effort has been spent to obtain a reliable estimate of the heritability of human intelligence, the results have as yet not been generally accepted. All approaches which have been made so far remain open to rather serious criticism. It would seem that MZ twins reared apart were an ideal material, and data from 122 such pairs have been reported. They show that separation at an early age does not significantly lower the concordance of their IQs, although the partners were brought up in different homes. However, neither do the twins constitute a true sample of individuals from the general population, nor do the homes in which they were brought up constitute a true sample of homes in the general population, as the adoption agencies always try to provide what is considered a good home for the child. These and other deficiencies of the data can hardly be corrected by sophisticated mathematical analyses, so that it is not possible to put much faith into the published heritability indices. Ordinary twin studies suffer from similar or other faults.

Nevertheless, one must conclude that the data — in spite of their deficiencies — rather indicate important genetic contributions to the variability of intelligence. When environmentalists use the present difficulties of quantisizing the results in order to minimize or zerosize the genetic variation, they are certainly making a major mistake which invites to serious social and economical repercussions.

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NATURE-NURTURE AND INTELLIGENCE: THE TWIN AND ADOPTION STUDIES AGREE

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Identical twins (even those separated near birth) are more alike in intelligence test scores than fraternal twins. This finding may mean that individual differences in intelligence are determined substantially by genetic differences between individuals. Critics of the twin method have suggested that twin results should not be generalized to the larger population of singletons, particularly if the trait is influenced by being born a twin. Since the average IQ of twins is at least a third of a standard deviation below the average IQ of singletons, data from other sources is needed before the twin results are generally accepted.

A large scale adoption study is underway at the University of Texas where IQ test scores are available for over 1200 women who gave up their children for adoption immediately following delivery. The adopted children and their adoptive families are now being located and tested and, if current trends continue, complete data should eventually be available on over 400 families. About half of these families will contain two or more adopted children or both adopted and natural children. At present, data is available for 56 families. The results are consistent with the twin data and support a genetic hypothesis. The biological mother-adopted child correlation is 0.51 whereas the adoptive mother — adopted child and adoptive father — adopted child correlations are only 0.33 and 0.20 respectively. There are 26 pairs of unrelated children reared together in this sample and the IQ correlation for these children is only 0.12.

When the study is completed the large sample size will make possible a number of informative analyses. The reaction range for intelligence can be estimated from the IQ scores of children with lower than average IQ biological mothers and higher than average IQ adoptive parents. The effects of selective placement, common family environment, parent-child influences, and genetic resemblance, can be separated and