The Colorado Adoption Project

The Origins of Individual Differences in Infancy. The Colorado Adoption Project. ROBERT PLOMIN and JOHN C. DEFRIES. Academic Press, Orlando, Fla., 1985. xvi, 408 pp. $54.50. Developmental Psychology Series.

In developmental psychology, the adoption design has been touted as the only effective method for disentangling the influences of heredity and environment in the genesis of behavior. Infants relinquished for adoption at an early age are raised by adoptive parents with whom they share only environmental influences, while they retain a link of heredity with their biological parents. Insofar as the infants become increasingly like their adoptive parents with respect to intelligence and personality, a strong role for home and family environment is suggested. But if the infants seem to resemble their biological parents in spite of never having lived with them, a prominent influence of heredity is suggested.

Adoption studies have been revived in recent years after a long period in which interest in them had waned, and the early, well-executed studies of Burks and Leahy have been rediscovered as models for addressing the nature-nurture issue. Among current studies, the project reported in the book under review—the Colorado Adoption Project—stands at the pinnacle in design and methodology.

The project employs a full adoption design that is also a prospective longitudinal one, with infants being tested regularly throughout childhood. The adoptive parents and the biological parents are given a common battery of tests, and the adoptive homes are visited for a comprehensive measure of the home environment. Adoptive infants are usually placed in homes within the first month, with negligible evidence of selective placement.

In addition, a control family having its own infant is matched with the adoptive family for socioeconomic status and education, and this family is also entered into the longitudinal study. Since the parents in the control family share both heredity and environment with their offspring, the basic question is whether they show stronger relationships with their infants than either adoptive parents or biological parents whose offspring have been adopted away.

The Colorado Adoption Project was designed within the broader framework of developmental behavior genetics, with a focus on the origins of individual differences in behavior. Conceptually, it has benefited from the recent view of genes as dynamic entities that may act at specified chronological points in development and thus contribute to change as well as to continuity in behavior. On the environmental side, the project has incorporated the major recent scales for home and family assessment and has been sensitive to the question of how certain environments may interact with genetic predisposition.

Above all, the project has employed an omnibus set of measures in infancy and in adulthood so that the major domains of behavior can be assessed. If heritage and home environment have differential effects on behavior, then the various parent-offspring correlations should fall in a specified order. Indeed, the relative weight for heritage and home environment can be estimated from sophisticated path-analysis models that partition the variance between genetic makeup and environment, both as main effects and in interaction.

The authors furnish an engaging history of how the Colorado Adoption Project was initiated; then they turn to the central feature of the adoption design—the analysis of parent-offspring correlations. They acknowledge that the parent-offspring design is not powerful for detecting genetic influences in infancy, partly because the reference behaviors may differ from infancy to adulthood, and partly because the gene complement may not be fully expressed in infancy. Nevertheless, the design provides an instant longitudinal study by comparing infants with their biological parents, and from this comparison is obtained the measure of genetic continuity.

The adoption sample was drawn principally from the Denver metropolitan area; it is nearly 90 percent Caucasian and is generally representative of urban middle-class families. There are 182 adopted infants and 165 control infants who were tested on a common battery at 12 and 24 months of age. Virtually all the adoptive parents and control parents were tested on the adult battery, as were the biological mothers, but a far smaller sample of biological fathers was available for testing.

The omnibus test battery for infants and adults is both intensive and diverse. Measures of cognition, temperament and personality, language development, and behavior problems are included in the battery, plus a host of auxiliary measures related to health, motor development, and physical growth. Most of the measures are state-of-the-art. The extensive infant assessment carried out at 12 and 24 months can be lauded as a model of well-conceived design and examiner persistence in capturing the distinctive behavioral style of each infant.

The environmental measures were also comprehensive, and they entered into the second major aim of the study, the detection of environmental influences on infant development. One recurrent theme throughout the book is the genetic mediation of ostensibly environmental relationships, as detected by larger parent-offspring correlations in the control families than in the adoptive families. Indeed, the finding of such mediation is a major conclusion from the study, one that will recast thinking about many prior studies in which environmental influences were inferred from results in which home and heritage were confounded.

The results are reported in separate chapters for general cognitive ability, specific cognitive abilities, language development, temperament and personality, and behavior problems. The analyses are very detailed and follow the sequence of examining for genetic effects, for environmental effects, and then for any gene-environment interactions or correlations. The number of reported correlations is mind-numbing, and some concentrated effort is required to absorb them fully and to extract the significant themes. Reading the chapter summary before moving into the main body of the text is recommended.

In broad overview, the results demonstrated a significant although limited genetic relationship between infant mental development and adult intelligence. The relationship was evident for general cognitive ability, or *g*, but not for specific cognitive abilities.

Some relationship was found for environmental influence on mental development, but an even stronger relationship appeared in control families, which implies a partial genetic mediation of this environmental link. Here, as elsewhere, there was no evidence of gene-environment interaction or correlation. The au-

thors conclude that genetic variance was less important for infant mental development than for adult intelligence, but the genes that affected infant scores were correlated with the genes that affected adult scores.

For temperament and personality, the infants' scores were aggregated into three composite scores representing affect-extraversion, activity, and task orientation; and these were then compared to the parents' scores on extraversion and neuroticism (from Cattell's 16PF) and on emotionality, sociability, and activity (from Buss and Plomin's EASI).

Some correlations were found between maternal sociability/extraversion and the corresponding measure in the infant, but in the main parental personality had little power to predict infant temperament. Environmental correlates were not robust either, although one dimension of family organization termed personal growth was correlated with sociability in the infant.

The book closes with a provocative and sometimes optimistic set of conclusions drawn from the study, which give considerable prominence to genetic continuity between infancy and adulthood. One can accept this conclusion while being skeptical about the values of the genetic correlations that are adduced to support it. Heredity does play a role in individual differences; it contributes to developmental change as well as continuity, and it enters into certain ostensibly environmental relationships with infant development.

As the authors observed, the inherent limitation of the parent-offspring design was such that neither genes nor environment could account for a large proportion of the variance. As the infants get older and as other siblings are added to the study, we may expect a more powerful data set to appraise the role of genes and environment in guiding the course of development.

Any research project so large and complex involves countless decisions about data analysis that might be questioned, and this one is no exception. Factor analysis is heavily employed as a way of condensing variables and generating scores for the families, and often the factor scores represent only a limited proportion of the variance among the selected variables.

For example, the so-called IQ scores for the parents are based on the unrotated first factor obtained from 16 specific cognitive ability tests, and the first factor represents only 36 percent of the variance among the ability tests. A single-factor score of this sort is clearly losing some significant information about IQ.

The same approach was taken with the various environmental measures and personality/temperament measures, with some derived factor scales replacing the original scales. The authors are forthright about how the scales were created and what proportion of variance they account for, but when the results are reported in later chapters the reader must recall that the designated variables such as parental IQ are derived surrogates with reduced power. Perhaps some of the low-order relationships are due to the diminished variance represented in the factor scores.

Factor analysis also was employed in a marginal manner with the items from the Bayley Mental Scale. The Bayley items are arrayed by order of difficulty, without regard to content, and consequently the item intercorrelations are higher for adjacent items and lower for remote items. This generates a simplex matrix with a predetermined factor structure, and it is imprudent to use item factor loadings as a basis for identifying specific cognitive skills in infancy.

The path analysis model is a powerful analytic tool, and it does provide a genetic correlation between infancy and adulthood, but a caveat should be entered here against taking the genetic correlation too seriously. As computed in this model, the correlation can take on values exceeding 1.00 and gives an artificial impression of correspondence between infancy and adulthood that far exceeds the empirical correlation for the behavior involved.

Such detailed criticisms could be multiplied manyfold, but it is important to recognize that they represent only a mildly dissonant counterpoint to a very strong theme. The design and execution of this adoption study are without parallel in psychology, and only those investigators who have labored in longitudinal studies can fully appreciate what a major accomplishment the study is. With trivial exceptions, it is a textbook case of how the complete adoption study should be performed.

The assessments are comprehensive and well chosen, the samples are well matched and reasonably representative, the retention rate is high for families in a longitudinal study, and the analyses are drawn from the powerful models in quantitative behavior genetics. If the results are somewhat tentative at this point, it is because the authors have shouldered a heavy burden in looking for parent-offspring relationships between infancy and adulthood.

As it stands, this book is an invaluable description of a research program and a sophisticated discussion of the behavior-genetic concepts that undergird it. The results are a provocative preview of more powerful results to be expected five years hence. It is an authentic landmark study, and when the final history of developmental psychology is written its impact will loom large.

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Lewis Strauss

No Sacrifice Too Great. The Life of Lewis L. Strauss. RICHARD PFAU. University Press of Virginia, Charlottesville, 1985. xii, 314 pp., illus. $17.95.

Lewis Strauss was a major figure in the politics of U.S. nuclear policy. He was a member of the Atomic Energy Commission (AEC) from 1946 to 1950 and chairman from 1953 to 1958. It is useful therefore to have Richard Pfau's documentation of Strauss's positions on important postwar issues. However, Pfau does not match thoroughness of research with persuasiveness of interpretation. His overall view of Strauss as a tragic hero is ultimately too exaggerated to sustain.

Pfau describes how Strauss's first encounter with Washington administration changed his life. In 1917, at 21 years of age, he volunteered for administrative duty with Herbert Hoover's Food Administration, and by luck and design became the great man's personal secretary. As a result, he gained permanent membership in Hoover's Republican circle and also found his way into the world of investment banking. He joined the Wall Street firm of Kuhn, Loeb in 1919.

Strauss prospered between the wars. His income rose. So did his status. He became active in Jewish philanthropic organizations. He campaigned for Hoover in 1928. He took a commission in the naval reserve, and in 1941 he went on active duty. In five years of distinguished wartime service he contributed to a number of projects, including development of the proximity fuse and naval planning for postwar programs. His war work brought him into close contact with Navy Secretary James Forrestal, a former Wall Street acquaintance, Navy partisan, and fervid anti-Communist; and his term as Forrestal's representative on the Interim Committee on Atomic Energy led him to the AEC in 1946.