THE INFLUENCE OF "FAMILY BACKGROUND" ON INTELLECTUAL ATTAINMENT*

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"Family background" frequently has been found to have long-term effects on adult intellectual, occupational, and economic outcomes. Since families differ both genetically and environmentally, it has been difficult to interpret family effects in studies of individuals or biological relatives. This study includes samples of adoptive and biologically-related families with children between 16 and 22 years of age. We regressed child IQ on several family demographic variables, on parental IQ, and on natural parent characteristics (for the adopted children) to estimate the degree of genetic bias in the coefficients on measured family background. The results indicate that there is little effect of those family environmental differences studied on IQ differences among the adolescents in the SES range of working to upper middle class. Parent-child and sibling correlations further indicate that genetic differences among families account for the major part of the long-term effects of "family background" on IQ.

Family background has been much discussed and studied recently as a source of inequality among American adults (Behrman et al., 1978; Duncan, 1968; Duncan et al., 1972; Grilliches and Mason, 1972; Jencks, 1972; Jencks and Brown, 1978; Sewell and Hauser, 1975; Taubman, 1976; Taubman and Wales, 1972; 1974). That accidents of birth leave us at the mercy of our families' fortunes and that home environments can affect life chances strike most social scientists as unfair, undemocratic, and even morally wrong. Even more difficult for some to accept is the idea that genetic differences among individuals and families can control some of our differences in adult achievements. The impact of family environmental and genetic differences on intellectual outcome of children is the subject of this study.

It frequently has been reported in recent years that "family background" continues to affect intellectual, educational, occupational, and income differences long after children have grown up and left home. Some vaguely specified characteristics of the offspring are differentially rewarded by employers, and those offspring traits are correlated with parental and home characteristics, even 30 years after the offspring have left home. Although there are substantial differences among studies in the magnitude of the effects they find for family variables (Leibowitz, 1978; Crouse, 1978), there is no sign that the effects diminish with time; in fact, Taubman (1977a) reported stronger effects of "family background" and own IQ as one approaches middle age.

Studies of outcome differences among the offspring of biologically-related families confound four sources of variance: within and between family, envi-

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ronmental and genetic differences. Regressions of individual outcomes on differences in family background are not illuminating as to the genetic or environmental sources of outcome differences, because parents transmit both genes and family environments, that are likely to be correlated with each other and with genetic differences between families. In other words, the genetic variance in the predictors is likely to be correlated with the genetic variance in the outcomes. As unreconstructed liberals, we get upset about the long-term environmental effects of families on their offsprings' life chances. When individual outcomes are shown to be affected by "family background," we don't know how upset to be.

Behavior Genetic Methods

As Taubman and his collaborators (Behrman et al., 1978) have shown, twin study methods can help to define what is subsumed by the term "family background." Behavior genetic methods have long included the study of genetically and environmentally related and unrelated people (and mice, dogs, etc.). The contrast of effects from similar and different treatments on similar and different genotypes has been a continuing fascination for the field. Families are the usual source of human beings aggregated in related groups. Fortunately, for behavior genetic studies, there are also families who are genetically unrelated but aggregated through adoption. Also beneficial to the field has been the tendency of human populations to produce occasional litters of offspring, some of them genetically identical and others no more alike than sibs. Adoptive families and twins offer unique but different opportunities to study the effects of genes and environments on the outcomes of offspring. The confluence of behavior genetic and social science methods to study the effects of "family background" will provide new insights into true environmental effects.

As Jencks and Brown (1978) have indicated, there are two basic approaches to estimating the importance of environmental differences in determining differences in outcomes. First, they say, one should begin by offering some meaningful definition of what one means by environment. One strategy is to specify what one means by *measured* environment and study the effects of differences in home background on unrelated children, adopted into the homes. A second strategy is to look at only those environmental influences shared by children reared together. One can estimate the contribution of such influences to phenotypic inequality by calculating the correlation between the phenotypes of genetically-unrelated parents and children and unrelated children reared together.

A third way to obtain an estimate of the true environmental effects of family background would be with identical twins reared apart in uncorrelated environments. Genetic differences would be controlled, while both within- and between-family environmental effects would be free to vary. Unfortunately, child development experts repeatedly have warned about the psychological hazards of giving away one of a pair of twins, and there are simply too few cases, too peculiarly sampled, to make these subjects useful to social science.

Adoptive Families

Adopted children, on the other hand, provide almost as useful data as the rare identical twins reared apart, and they are far more available. Adopted children are not genetically descended from the family of rearing, so that environmental differences between families are not confounded with genetic differences in the children, if the adopted children are randomly placed by adoption agencies. Theoretically, regressions of adopted child outcomes on adoptive family characteristics will provide genetically unbiased estimates of true environmental effects in the population. Unfortunately, adoptive families are selected by agencies for being above average in many virtues including socioeconomic status. Thus, they are always an unrepresentative sample of the population to which one would like to generalize. Although it is possible that the adoptive family coefficients on background are good estimates of the population values, it is difficult to know without modeling the way in which the families were selected. An easier corrective for the possible bias of selected adoptive families is to have a comparison sample of biologically-related families that are similarly selected.

The study to be reported in this paper includes both adoptive and biologically-related families. The comparison of regression coefficients on measured family background for adoptive families with those of biological families is an estimate of the extent of the genetic bias in studies of family background effects in the usual sociological and psychological studies of families. An additional focus of the paper is on family correlations for IQ. The comparison of similarities among related and unrelated children, and the comparison of related and unrelated parent-child correlations, is the best estimate of the true environmental effects of total, shared family background. The children to be reported here are the oldest adoptive sample ever studied. The study was designed to assess the cumulative impact of family environments at the end of the child-rearing period. If differences in family environments have lasting impact on individual differences in intellectual functioning, the study of adolescents, adopted in the first few months of life, should reveal those differences.

METHOD

Subjects

The 845 subjects in this report are members of 120 biological and 104 adoptive, white families in Minnesota. The adoptive families included 194 adopted and 15 biological children between the ages of 16 and 22. In the first section of this report, only the 150 adopted children whose natural mothers' educational levels were known are included. In the second section, all adoptees are included. The biological families include 237 children with complete data and 268 with IQ data. Adoptive families were recruited through the Department of Public Welfare (DPW), whose director sent letters on behalf of the study to 1,620 families who had adopted children between 1953 and 1959. We were interested particularly in families who had adopted at least two children, so that our recruitment concentrated on those volunteers with two available children between the ages of 16 and 21 at the time of testing. Table 1 gives the details of adoptive family recruitment.

Of the 1,620 letters sent by DPW, 477 were returned to us without forwarding addresses, which was hardly surprising since the addresses were 15 to 20 years old. Another 345 letters received no response, which may mean that they were not received or that the family chose not to acknowledge our attempted contact, even though follow-up letters also were sent. Of the 798 families known to be eligible to participate, 471 agreed to come to the university for a half-day testing session. Many of those who refused lived far across the state and were unable to join the study. Others did not choose to subject themselves to such extensive scrutiny. The final interview sample who came to the university consisted of 115 families; nearly all of these families have two children in the designated age range and were conveniently accessible to the university. An additional 164 families, most of whom had only one child in the prescribed age range, participated in the mail sample that will not be discussed in this paper. Other willing families were not recruited because of funding and time limitations.

To check on the representativeness of the sample recruited for the study, we

Table 1. Recruitment of Adoptive and Biological Families

Adoptive Families		
Letters sent by DPW		1,620
Letters returned undelivered		477
No Response		345
Eligible to participate		798
Said No	327	
Said Yes	471	
Participate		
By mail		164
By interview		110*
Biological Families		
Eligible to participate		?
Recruited by adoptive families		41
Recruited by media		153
Participated		
By interview		122*

* The samples reported in this paper.

compared the socioeconomic characteristics of participants and nonparticipants at the time of adoption. Since we had no data on the nonparticipants in later years, this was the best comparison we could manage. There were no age, income, educational, occupational differences between participants and nonparticipants (refusals or nonrespondents) at the time of adoption, but, of course, there may be some current differences in the outcomes of their adoptions or family life histories that we are unable to detect by this method.

The biological families were recruited through newspaper articles and advertisements, word of mouth, and the adoptive families. Approximately 153 biological families came from public media contact and about 41 from recommendations of the adoptive families. Of these, 122 were randomly chosen to come to the university for the full evaluation.

All families who participated in the interview procedure received small payments for their time and transportation and bonuses for recruiting other families. The data were collected from July 1974 to June 1976.

A crucial methodological consideration for any adoption study is the age at which the children are placed with their adopting families. Only early placements can guarantee that potentially confounding, early environmental experiences are minimized. All of the children in this study were in their homes before 12 months of age. Exact age of placement was available for 171 of the 194 adopted children. The mean age of placement into the adopted children's present homes was 2.6 months. Of these 171 children, 109 were placed before two months of age, 158 were placed at or before six months. All but six of the 171 were placed by age nine months. Of all the children for whom placement data were available, there is only one case in which the natural mother may have had social contact during the first 68 days. In all other cases the child left the maternity hospital for the adoptive home or a foster placement. All adopted children were genetically unrelated to their adoptive parents and to each other. The biological children were all full siblings and claimed to be the biological offspring of both parents tested.

Procedure

Subjects in the sample were administered a three-hour battery of tests and interviews at the University of Minnesota as part of a behavior genetic study of intellectual, personality, and attitudinal similarities within families. The data to be reported here are from the *Wechsler Adult Intelligence Scale* (WAIS; Wechsler, 1955), an individually-administered IQ test. Four subtests of the WAIS were administered: vocabulary, arithmetic, block design, and picture arrangement. The combination of these four subtests has been shown to correlate above .90 with the full scale test score and is generally accepted as a shortened version of the adult test (Doppelt, 1956). The test protocols were scored by an experienced psychometrician who was unaware of the respondents' adoptive status.

After scoring all of the tests, we became aware of a substantial sex difference on three of the four subtests, a fact seldom reported in the literature, but of which the Psychological Corporation seems to have been aware for some time (Herman, 1977). From the point of view of regression analysis, these mean sex differences are not critical, because there are about the same proportion of male and female children in the adoptive and biological samples (47 and 45% male, respectively).

RESULTS

Socioeconomic Variables

The socioeconomic characteristics of the biologically-related and adoptive families are shown in Table 2. Parental educational levels in both kinds of families are .75 to 1 standard deviation above the averages of their cohorts in the population. The occupational prestige of the fathers, rated on the expanded NORC scale (Reiss, 1961) is about 60 in both types of families. Since less than half of the mothers were employed, their occupational ratings were not used in the analyses. Family income averages $25,000 to $26,000 in both types of families.[1] The variance of the educational, occupational, and income measures is not as restricted as the high means might imply. In fact, the standard deviations are roughly comparable to the population figures (Taubman's veteran twin sample; Taubman, 1977b). Two points should be made, therefore, about the socioeconomic characteristics of these families: first, the adoptive and biological families are fairly comparable, and second, they both represent selected portions of the SES range in the U.S., both regionally and within the region from which they are drawn. It is well-known that volunteers in social science research are self-selected for better-than-average characteristics of all kinds, and the sample of biological families is at least as biased in SES characteristics as the adoptive one. This is what we hoped would happen, without the statistically hazardous procedure of matching individual families.

The adoptive and biological parents also are comparable in mean IQ scores and in the variance of their scores. Compared with the standardization sample for the WAIS, the fathers are more than a standard deviation above the mean and the mothers about ¾ of an S.D. above. It is not accidental, of course, that samples with above-average income, education, and occupational status also score above the average on a standard IQ test. The standard deviation of the parental IQ scores is only ¾ of that of the population, a signification restriction. Their scores are significantly restricted in range, with the lowest scores in the midnineties.

Table 2. Means, Standard Deviations, and Correlations of Adoptive and Biological Family Characteristics

	Biological Children (*N* = 237)										Mean	S.D.
1 Child's IQ	1	2	3	4	5	6	7	8	9			
		.26	.24	.10	.22	−.19	−.21	.39	.39		112.82	10.36
2 Father's Education	.10		.51	.61	.44	.01	−.36	.56	.24		15.63	2.83
3 Mother's Education	.10	.51		.36	.39	.02	−.36	.43	.46		14.68	2.24
4 Father's Occupation	.12	.57	.25		.47	.01	−.30	.37	.13		62.47	24.73
5 Family Income	.06	.50	.40	.46		.00	−.25	.38	.19		24,987.34	8,770.43
6 Birth Rank	−.19	.05	.03	.06	.15		.08	−.00	.03		1.62	0.63
7 Family Size	−.05	.04	.11	−.00	.21	.10		−.30	−.10		3.85	1.48
8 Father's IQ	.15	.53	.30	.40	.45	.08	.14		.20		118.02	11.66
9 Mother's IQ	.04	.29	.44	.19	.21	.07	.12	.30			113.41	10.46
10 Natural Mother's Age	−.10	.04	.03	.12	−.02	−.11	−.04	−.10	.03			
11 Natural Mother's Education	.21	.33	.24	.29	.43	.09	.14	.20	.10	.07		
12 Natural Mother's Occupation	.12	−.00	.13	.11	.06	−.06	.11	.11	.15	.28	.33	
	1	2	3	4	5	6	7	8	9	10	11	
Mean	106.19	14.90	13.95	60.30	25,935.00	1.43	2.87	116.53	112.43	22.46	11.97	30.44
S.D.	8.95	3.03	2.06	24.14	10,196.78	0.57	1.20	11.36	10.18	5.80	1.66	23.24
	Adopted Children (N = 150)											

r ≧ .16, p < .05.

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[1] Occupations of the fathers in the two samples varied from janitor, auto mechanic, small farmer (income < $10,000), telephone installer, and sheet metal worker at the low end to physician, engineer, college professor, and radio station owner at the high end of the scale. Most occupations were in the middle range of carpenter and printer to insurance agent and building contractor.

The income levels of the families may appear to be higher than they are, unless parental age is taken into account. In 1974, the median family income in the North Central region was $14,017, but the median family income for families headed by workers aged 45–55 was approximately $18,000. The families in this sample are less than one standard deviation above that value.

The children of the two types of families are quite comparable in age, the mean being about 18½ in both groups. The range of ages is 16 to 22 in both groups (with a few older or younger exceptions). There was no correlation between age and IQ. The IQ scores of the adopted children are about 6½ points lower than those of the biological children, however. These results also are shown in Table 2. If IQ is heritable to any extent, one should expect the biological offspring of bright parents to have higher IQ scores than unselected people. The adopted children are not a genetically selected group. Their natural mothers averaged 12 years of education at a present average age of 41. The median educational level for women, aged 25–44 in the Minnesota area, is 12.5 years of education. Education is an indirect measure of intellectual ability, but as we have shown in another study, there is good reason to expect that intellectual level of the natural mothers is reasonably well indexed by their educational levels (Scarr and Weinberg, 1976;1977a;1977b). Furthermore, there was a large study of unmarried mothers in the state of Minnesota during the years 1948–52, when IQ tests were mandated for all women giving up children for adoption. The average IQ score of 3,600 women was 100.00 with a standard deviation of 15.4 (Pearson and Amacher, 1956). Since our mothers were sampled from 1953–59, there is no reason to expect them to differ significantly from the normal population. Fathers, of course, should not be expected to deviate from the average of the population any more than mothers. Thus, the adopted children are genetically a sample of an intellectually average population, while the biological children are more selected.

Correlations among Parental Characteristics

The parental educational levels, family income, and father's occupation are similarly correlated in the biological and adoptive families. Despite the above-average means on all of these variables, the correlations are either greater or of the same magnitude as those reported from more representative samples by Sewell and Hauser (1975), Jencks (1972), and others. These two facts—the comparability of correlations in the two samples and their comparability with more representative samples—encouraged us to proceed with the regression analyses.

As Table 2 shows, mothers and fathers in the adoptive and biologically-related families are assortatively mated for educational level with a correlation of about .50. Sewell and Hauser (1975:72) reported .52. Father's education correlated with his own occupational status (NORC scale) about .59. Sewell and Hauser reported .43 (Duncan SEI). Father's occupational status correlated with family income about .46, the same figure obtained by Sewell and Hauser. Mother's education is somewhat more correlated with father's occupational prestige in biological than adoptive families (.36 vs. .25), and Sewell and Hauser reported .29. In these samples, mother's education correlated more highly with family income (.40) than in Sewell and Hauser's study (.24), perhaps because our mostly urban mothers may be more likely to be contributing to that income.

From an examination of the means, variances, and correlations of family demographic characteristics, we concluded that there were no important differences between the adoptive and biological families in the study. The correlational patterns were sufficiently similar to those for more representative samples that the regression analyses are probably more directly generalizable to the general population than we had feared from the selected characteristics of the families.

Parental IQ Correlations

Fathers' and mothers' IQ scores were moderately correlated with the family demographic characteristics, as might be expected. In both the adoptive and biological families, father's IQ was more highly correlated with his educational attainment than mother's was with hers. We suppose this says something about selection for advanced education for women in the cohort that is now 45–55 years of age. Adoptive fathers' correlation of IQ score with occupational prestige is a bit lower than the biological fathers' (.39 vs. .51). Adoptive parents' IQ scores correlated .31, and biological parents', .24, a moderate difference in assortative mating for IQ. There are no other striking differences in the correlations by family type.

Family Size and Birth Rank

The adoptive families have on the average fewer children than the biological families (2.9 vs. 3.9). The average birth rank of those children who were of appropriate age to participate in the study, however, did not differ much in the two types of families. In both cases, the participants were between first- and second-borns, on the average (1.4 and 1.6 in the adoptive and biological families, respectively). This means that the participants from the biological families have a larger number of younger siblings than the adopted children.

Parental characteristics surprisingly are correlated with family size in the biological families. Although it has often been reported in the general population that family size is negatively correlated with parental IQ, occupational status, education, and income, we did not expect to find such relationships in a socioeconomically advantaged sample. Yet, number of children is significantly negatively correlated with all of the family demographic characteristics and with father's IQ in the biological families. As we did expect, adoptive families with more children (the range of family size was from one to six children), were slightly more advantaged than those with fewer children, presumably because adoptive agencies select parents who can afford to rear more children.

Correlations with Children's IQ Scores

It is clear from Table 2 that parental education, family income, family size, and parental IQ tend to be more highly correlated with biological than adopted adolescents' IQ scores. (Father's occupation and birth rank are not.) The greater resemblance between adolescents' IQ scores and their parents' characteristics in biological families presumably results largely from the genetic resemblance, since both types of families share the home enviroment (at least, after the first two months of the child's life). The slight correlation between adopted child IQ and family demographic characteristics is confounded by the selective placement of children of better educated (probably brighter) natural mothers into adoptive families with higher levels of parental education, income, and occupational status. Since natural mother's educational level is moderately correlated with the adopted child's IQ, the correlations between adoptive family demographics and child IQ are inflated by the natural mother-child resemblance via selective placement.

Family size is unrelated to child IQ in adoptive families, but negatively correlated in biological families, probably because of the negative correlation between family size and parental characteristics in the biological families. From the adoption data, however, it is clear that family size per se is not a detriment to IQ in the range of adoptive family sizes represented in this study and at the socioeconomic levels of these families. Birth rank, on the other hand, is clearly related to IQ in both the adoptive and biological families. Laterborn or adopted children are at a slight disadvantage in IQ.

Selective Placement

Adoption agencies are not blind. They have information about the natural mothers' educational levels, occupational prestige and age, and they use it to match the children of the natural mothers to adoptive families. As shown in Table 2, there are substantial correlations between natural mothers' educational levels and the adoptive families' demographic characteristics, particularly family income and fathers' education. Fortunately for the study, the agencies do not have information on the IQ levels of the adoptive parents or the natural mothers, so that their effective matching for IQ is quite poor. The correlations of adoptive parents' IQ and natural mothers' education are only .20 and .10 for mother and father, respectively. If the correlation between natural

Table 3. Unstandardized Regression Coefficients of Adolescent IQ on Family Demographic Characteristics and Parental IQ in Biologically-Related and Adoptive Families

	Bio.	Adopt.	Bio.	Adopt.	Bio.	Adopt.	Adopt.	Adopt.
Family Characteristics/N	237	150	237	150	237	150	150	132
Father's Education	.855	*	.795	*	.262	−.153	−.248	−.074
Mother's Education	.551	.362	.465	.343	−.525	.378	.336	.282
Father's Occupation	−.065	.040	−.069	.038	−.059	.032	.035	.014
Family Income	.170	−.020	.160	.010	.100	−.020	−.090	−.085
Birth Rank			−2.699	−3.063	−2.724	−3.078	−3.419	−4.077
Number of Children			−.720	−.303	−.751	−.390	−.528	−.605
Father's IQ					.274	.125	.115	.091
Mother's IQ					.357	−.020	*	−.021
Natural Mother's Education							1.325	1.554
Natural Mother's Age							−.226	−.121
Natural Mother's Occupation								.009
R^2	.107	.019	.145	.059	.309	.075	.138	.157

* $F < .01$, variable did not enter the equation.

mothers' educational and IQ levels is .70, as Jencks (1972) believes, then the average of the correlations between natural mother's and adoptive parent IQ levels is only (.15) (.70) = .105. Since the agencies have little or no information about the natural fathers, the correlation between the IQs of natural and adoptive parents is undoubtedly lower than .10. This creates a small shared genetic variance in adoptive families, and accounts for less than 1% of the genetic variance in the population, compared with biologically-related families who share half of the genetic variance.

Regression of Adolescent IQ Scores on Family Characteristics

The major concern of this paper is with the predictability of children's intellectual outcomes from their family's demographic and intellectual characteristics. In the first set of equations, shown in Tables 3 and 4, father's education, occupation, mother's education and family income were used to predict the child's IQ. In the biological families parental education and family income are positive coefficients, and father's occupation is negative. This last, seemingly anomalous, result probably reflects the multicollinearity of the family demographic variables, as shown in Table 2. Once all of these intercorrelated variables are in the regression equation, one or more is likely to be pulled in a negative direction. More attention, therefore, will be given to the R^2's than to the particular regression coefficients. The total R^2 for the regression of biological children's IQ scores on their families' demographic characteristics in this sample is .107.

The total R^2 for the adopted child regression on the same variables is much lower, only .019.[2] The positive coefficients on parental education are lower than those in the biological family regression; family income is slightly negative and father's occupation is moderate and positive.

When birth rank and family size are added to the equation, the R^2's for both the biological and adoptive children increase by about .04 to .145 for the biological offspring and .059 for the adopted children. (The "birth rank" of the adopted children is their social, sibling order in the adoptive family; nearly all adopted chil-

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[2] It was suggested by one reviewer that the differences between the pairs of regression equations be tested by the Chow test. We have resisted calculating yet another statistic because our goal was magnitude estimation, not testing all possible null hypotheses. More importantly, the unequal sample sizes of the adoptive and biological families yield different expected mean squares, and any result would only be approximately correct, with unknown distributions and standard errors. Two leading textbooks on regression analysis (Cohen and Cohen, and Kerlinger and Pedhazur) either do not mention the test or are opposed to its being done, even with equal sample sizes.

Table 4. Standardized Regression Coefficients of Adolescent IQ on Family Demographic Characteristics and Parental IQ in Biologically-Related and Adoptive Families

	Bio.	Adopt.	Bio.	Adopt.	Bio.	Adopt.	Adopt.	Adopt.
Family Characteristics/N children	237	150	237	150	237	150	150	132
N families	120	104	120	104	120	104	104	99
Father's Education	.233^a	*	.217^a	*	.072	−.052	−.084	−.025
Mother's Education	.119	.083	.101	.079	−.113	.087	.077	.066
Father's Occupation	−.155^a	.108	−.166^a	.102	−.140	.085	.094	.037
Family Income	.145	−.027	.139	.015	.089	−.019	−.104	−.099
Birth Rank			−.162^a	−.195^a	−.166^a	−.196^a	−.218^a	−.253^a
Number of Children			−.103	−.041	−.107	−.052	−.071	−.079
Father's IQ					.308^a	.158	.146	.116
Mother's IQ					.361^a	−.023	*	−.024
Natural Mother's Education							.246^a	.293^a
Natural Mother's Age							−.147	−.074
Natural Mother's Occupation								.023
R^2	.107	.019	.145	.059	.309	.075	.138	.157
$F_{R^2} > 0$ (d.f. = # families	3.44^a	0.48	3.19^a	1.01	6.20^b	0.96	1.49	1.68

* $F < .01$, variable did not enter the equation.
^{a} $p < .05$.
^{b} $p < .001$.

dren are firstborn of their natural mothers.) Family size is a larger negative coefficient for biological children's IQ scores than for the adopteds', because family size is negatively correlated with demographic characteristics only in the biological families. The coefficients on the demographic characteristics in biological families are reduced slightly when birth rank and family size are added. In the adopted families, the demographic coefficients also are slightly reduced, except family income which is pulled from slightly positive to slightly negative by the addition of birth rank and family size. Birth rank has a higher coefficient for adopted children's IQ than for biological, thereby demonstrating it is entirely a social effect within families.

The addition of parental IQ scores has dramatically different effects on the regression equations in the biological and adoptive families. First, the R^2 for biological children's IQ scores is doubled to .309, whereas the R^2 for adopteds is increased by only .016, to .075. This striking difference in the overall effect of adding parental IQ to the equation must reflect the genetic contribution of biological parental IQ to their offsprings' IQ scores. There are also striking changes in the coefficients on biological family demographic characteristics once parental IQ has been added. Father's educational coefficient drops to ⅓ its former value, and mother's education is pulled to a negative coefficient. The coefficients on father's occupation and family income are reduced. Birth rank and family size coefficients remain virtually unchanged, however. The addition of parental IQ to the adopted children's regression changes the demographic coefficients very little, with the exception that the coefficient on father's education is now slightly negative.

The addition of natural mother's education, age and occupation doubled the R^2 for the adopted children, from .075 to .157. The coefficients on adoptive family demographic characteristics are reduced, reflecting a degree of selective placement, with the exception of family income which is more negative than in the equation without natural mother's characteristics. It is natural mother's education that contributes most to the changes in the equation.

Adding information on the natural mother's educational level, occupation, and age increased the R^2 of adopted children by about .09 over the R^2 with just family demographic, birth order, and family size information. The final R^2 of about .15 is comparable in size to the R^2 of the biological children equation with family demographic, birth order and family size information (.145).

Conclusions from Regression Analyses

Since the social environment is equally well (or poorly) measured for the biological and adopted children, the impact of direct measures of intellectual functioning for the parents is primarily accounting for the genetic contribution of parents to their biological offspring. In this regard, it is noteworthy that the addition of adoptive parental IQ data to the equation for the adopted children has little impact on the adoptive family demographic coefficients, whereas the demographic coefficients for the biological children are greatly changed. Adding parental IQ scores to the equation for the biological children increases R^2 by .16. Presumably having IQ data for the natural parents of the adopted children would cause a similar increment, even though these parents do not rear their children.

From these regression equations it is evident that significant regression coefficients of child IQ on family variables in studies using only biologically-related parents and children are based largely on genetic variance, as indicated by the different R^2's for the biological and adoptive families.

FAMILY CORRELATIONS

For the second approach to deciphering the meaning of the term *family background*, we used all of the subjects for whom IQ data were available, regardless of what other information might be missing. Thus, the samples of both adoptive and biological family members are considerably larger, ranging from 270 parent-child pairs in biological families to about 180 pairs in adoptive families. Significance levels for the data have been calculated on the numbers of pairs. A more conservative approach would be to use the number of independently sampled families. Which approach is more defensible is not agreed upon in the literature, and the reader can consult any table of significance levels for correlation coefficients and Fisher's z formula for the calculation of significance levels based on the number of families. Sample sizes for pairs of family members are given in the middle of Table 5, and sample sizes for families at the top.

By calculating the correlations for related and unrelated family members, we hoped to get an estimate of the degree to which similarity in intellectual outcome is conditioned by similarity in the rearing environment. This entails a comparison of biological and adoptive families and a comparison of parent-child with sibling correlations. Parents and children do not share the same rearing environment, whereas siblings do, regardless of their genetic relatedness.

In an earlier study of young adopted and biologically-related children, we found that parent-child correlations were much greater for the biologically-related pairs (yielding heritability estimates in the range of .4 to .7), but the sibling correlations were quite similarly high for both related and unrelated pairs (Scarr and Weinberg, 1977a; 1977b). We speculated that similarities among these young children were greatly influenced by their families' common rearing environments.

In this sample of late adolescents, we were able to check on the degree of family environmental influence at the end of the child-rearing period. The results for the parent-child pairs are quite similar to the earlier study, whereas those for the siblings are very different. The adopted siblings at the average age of 18½ hardly resemble each other at all.

The evidence for genetic effects is striking in all comparisons of correlations among members of the adoptive and biological families. Even though the scores of both biological and adoptive family members have restricted variance, the coefficients for the biological family pairs usually exceed those of the adoptive family members by a statistically significant amount. As Table 5 shows, in total IQ the biological parent-child pairs, the midparent-child and the child-child pairs are significantly more similar than the adoptive family members. Only in vocab-

Table 5. Correlations among Family Members in Adoptive and Biologically-Related Families (Pearson Coefficients on Standardized Scores by Family Member and Family Type) for Intelligence Test Scales

	Reliability	Biological (120 families)				Adoptive (104 families)			
Child Score	(*)	MO	FA	CH	MP	MO	FA	CH	MP
Total WAIS IQ	(.97)	$\underline{.41}$	$\underline{.40}$	$\underline{.35}$	$\underline{.52}$	.09	.16	−.03	.14
Subtests									
Arithmetic	(.79)	$\underline{.24}$	$\underline{.30}$	$\underline{.24}$	$\underline{.36}$	−.03	.07	−.03	−.01
Vocabulary	(.94)	.33	$\underline{.39}$	.22	$\underline{.43}$	.23	.24	.11	.26
Block Design	(.86)	$\underline{.29}$	$\underline{.32}$	$\underline{.25}$	$\underline{.40}$	.13	.02	.09	.14
Picture Arrangement	(.66)	$\underline{.19}$	.06	.16	$\underline{.11}$	−.01	−.04	.04	−.03

$\underline{\quad}$ = biological>adoptive correlation, $p < .05$.

Sample Sizes: Pairs of Family Members

	Biological				Adoptive			
	MO	FA	CH	MP	MO	FA	CH	MP
Children	270	270	168	268	184	175	84	168

Assortive Mating

	Biological FA-MO	Adoptive FA-MO
WAIS IQ	.24	.31
Arithmetic	.19	−.04
Vocabulary	.32	.42
Block Design	.19	.15
Picture Arrangement	.12	.22
Sample Size	120	103

MO = mother-child; FA = father-child; CH = child-child; MP = midparent-child.

* Reliability reported in the WAIS manual for late adolescents.

ulary are the adoptive family members similar at a level different from zero. It is no accident that vocabulary differences are most amenable to social environmental influence. Language is the mode of social exchange among human beings, genetically related or not, so that people who live together develop more similar verbal skills than random members of the population. Other skills are not notably similar among people who live together, unless they are genetically related. It also is not surprising that the skill most amenable to mate selection is vocabulary. Evidently, courting couples spend some time talking to each other, but are not as concerned with other intellectual skills!

From these family correlations one can calculate the differences between the adoptive and biological correlations and, depending upon the model, the heritabilities. Genetically-related persons in ordinary families share about half of their genes. Unrelated people share none of their genes, except through the selective placement of adopted children for IQ, of which there is only a slight bias in this study, as explained earlier. Even though they have always lived together, the correlations of adoptive fathers' and mothers' IQs with adopted children's IQ scores are .15 and .04, respectively, so that there is little evidence for either selective placement or social environmental influence on IQ differences.

Table 6 gives the difference between the IQ correlations of biological and adoptive relatives and the heritabilities, based on a simple-minded model: multiplying the difference between the correlations of biologically-related and unrelated pairs by 1.6, based on biological families sharing half of the total genetic variance plus that portion due to assortative mating ($r = .25$ for parents). A footnote to the Table explains this calculation. This naive model throws the genotype-environment covariance (if any) into the genetic term, because only biologically-related parents transmit both genes and environments to their offspring. The heritability terms calculated here are really additive genetic variance plus GE covariance in the parent-child comparisons and broad heritability (including some dominance) in the sibling comparisons. The inexactitude

Table 6. Differences between the Correlations of Genetically-Related and Unrelated Family Members and "Heritabilities"

	Related-Unrelated				$1.6(r_{np\text{-}c} - r_{ap\text{-}c})$*		
Child Score	MO	FA	CH	MP	MO	FA	CH
Total WAIS IQ	.31	.24	.38	.38	.50	.38	.61
Subtests							
Arithmetic	.27	.23	.27	.37	.43	.37	.43
Vocabulary	.10	.15	.11	.17	.16	.24	.18
Block Design	.16	.30	.16	.26	.26	.48	.26
Picture Arrangement	.20	.10	.12	.14	.32	.16	.19

MO = mother-child; FA = father-child; CH = child-child; MP = midparent-child.

* The usual calculation for heritability would be to multiply the difference between the biological and adoptive family correlations by two, because the resemblance of bio members depends on sharing half their genes and home environments and that of adoptive members on sharing only the family environment; thus, the difference equals half of the genetic variance in the populations from which the families were sampled. But biological parents and their children (and siblings) are genetically related by half *only* when parents are mated randomly for the trait being measured. Because parents are not randomly mated for intelligence (the correlation being about .25 in this sample), there is less genetic variability within the biological families, which leads to a higher correlation among the biological family members. To correct for this in the comparison of biological and adoptive family pairs, it is necessary to multiply the difference between the pairs by 1.6 rather than two based on the following formula:

$$r_{bio} - r_{adopt} = \frac{1+m}{2} h^2$$

where m is the phenotypic correlation between the parents.

of the measures, however, makes this distinction academic, in all probability.

The differences between biological and adoptive family correlations in total IQ range from .24 to .38. Multiplying this difference, then, we find that the values for the combination of genetic variance and GE covariance range from .38 to .61. Although this range of heritability values is a far cry from .80, it is substantially different from zero.

In the simplest-minded genetic model that assumes no environmental transmission or genotype-environment covariation, the regression of offspring value on midparent value is an estimate of narrow heritability or the proportion of additive genetic variance in the total variance (Falconer, 1970). The value of the midparent regression coefficient for total IQ is .52, as shown in Table 5. By a more sensible model for behavioral traits, one that allows for environmental transmission, the regression of adopted offspring on adoptive midparent values is subtracted from the biological midparent-child regression. The resulting value of the midparent heritability estimate for total IQ is .38 in the population from which we sampled.

We have focused on the total IQ score for several good reasons. First, the other tests are parts of this larger whole. Second, the subtests are less reliable than the total score. And, last, the meaning of the whole is greater than the parts taken singly. It is also clear that total IQ has the highest heritability as estimated from the parent-child correlations and from the sibling comparison. These results lead to the same conclusion reached earlier from the regression of child IQ on the family background and parent IQ data; namely, that half or more of the contribution that parents make to differences in their offsprings' intellectual level is genetic.

We have resisted so far, from ignorance and fear of some formidable critics, the temptation to analyze our data in more sophisticated ways. We cannot defend all of the assumptions that must be made to justify elaborate models, and therefore have hesitated to throw ourselves into an inevitable fray.[3] Nonetheless, it seems

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[3] At the time of writing, Morton and Rao (1977), Cavalli-Sforza and Feldman (1973;1977), and the Birmingham group in genetics (Eaves, 1975:1976; Jinks and Fulker, 1970; Martin and Eaves, 1977) each have proposed various models for the transmission of family effects. Goldberger (1975:1978) has questioned the assumptions and specifications of most of them. There is no one set of assumptions or parameters that is satisfactory to convince unbelievers. Therefore, we have presented our data in a form that can be modeled by the various groups, who may then defend their own models.

An analysis of means from this adoption study in relation to biological and cultural transmission of intellectual skills recently has been done by Cavalli-Sforza and Feldman (1977). Using parental education as an environmental index, they obtain an estimate of cultural transmission (n) of intellectual skills in the adoptive families as follows:

> We can obtain an estimate of n from the mean IQ of adopted children (which is 6.2/15 = 0.41 standard deviations above the general mean of the population):
>
> $n = 0.41/0.74 = 0.55 \pm 0.06.$

evident to us that the study of adoptive and biological families provides extensive support for the idea that half or more of the long-term effects of "family background" on children's intellectual attainments depend upon genetic, not environmental, transmission. Furthermore, in the range of environments sampled in this study, there is little evidence for any measured environmental effects in "family (SES) background." Birth order is the only variable with substantial effects in the adoptive families, and that accounts for about 4% of the IQ variation among the adolescent children.

DISCUSSION

Accidents of birth do leave us at the genetic mercy of our parents, it seems. Different people have different reponses to the same environment, and the effects of differences in environments within the range we sampled are very small. The comparison of the coefficients of child IQ on family background would lead one to conclude that in unrelated families the effects of the demographic variables we measured are nearly nil. Even adding a direct measure of social parental IQ does not substantially increase the explained variance for adopted children's IQ differences.

The IQ coefficients for biologically-related children are highly biased in regression equations, because the demographic variables are indirect measures of the parents' abilities, which are transmitted to the offspring genetically as well. Adding demographic information about one of the natural parents of the adopted children doubles the explained variance, even though that parent has never had social contact with the child after the first few days in the hospital nursery. If we had information about the other parent, there is every reason to believe that the R^2 would rise considerably. Thus, the final equation for the biologically-related children with an R^2 of .31, is about four times as great as that of the adopted children with comparable information about the social class environment alone (even including some selective placement).

It may be thought by some readers that some unmeasured variables that *really* matter in determining children's intellectual development do not vary in these adoptive families, which were selected by the adoption agencies. To argue that the lack of effect of differences among the demographic and intellectual characteristics of the adoptive families is due to this underlying lack of variation, one must simultaneously explain the considerable regression of child IQ on the same family variables, in the same ranges, in the biologically-related families. Presumably, the argument would be that the biological families were not screened by agencies and do vary on those unmeasured family characteristics that *really* matter.

Fortunately, in a younger sample of transracially-adopted children, we have the same data on adoptive families with their own biological children. Table 7 gives these data. For 143 biological offspring of the adoptive parents, the R^2 from the regression of child IQ (at an average age of ten) on family demographic and parental IQ is .301. For the adopted children *in the same families* (N = 111, at an average age of seven), the R^2 is .156, or about half of the coefficient for the biologically-related children. This result is

Table 7. Regressions of Child IQ on Family Demographic Characteristics, and Parental IQ in Transracial Adoptive Families with Their Own Children

	Biological Children (143)		Early Adopted Children (111)	
	B	beta	B	beta
Mother's IQ	.474	.32	.141	.13
Father's IQ	.513	.40	−.028	−.02
Father's Education	.682	.14	.389	.09
Mother's Education	−.943	−.15	1.501	.25
Father's Occupation	−.174	−.23	.008	*
Family Income	.445	.06	−.371	−.06
Total R^2	.301		.156	

* F < .01, variable did not enter the equation.

> The indication from this preliminary analysis is that the results from means make cultural inheritance about as important as biological inheritance. (Cavalli-Sforza and Feldman, 1977:10)

Their analysis is in agreement with a heritability estimate of .5, the value we propose from our family correlations (Table 6).

in accord with Burks's (1928) regression of adopted and biologically-related children's IQ scores at an average of seven years on family background indicators. She found R^2's of .37 and .18 for the biological and adoptive families, respectively.

We have argued (Scarr, 1977) that the younger adopted children's intellectual skills are more affected by their parents' characteristics and family environments than the adolescents in the present study, who at the average age of 18½ years, have "gone their own ways" in school and community settings and are less subject to the effects of family differences than are younger children. Nonetheless, the selection of adoptive parents by agencies does not decrease the impact of family differences upon their biological children, and differences among the same parents have less impact on their adopted children.

Compared with the regression equations for biologically-related adolescents, the magnitude and signs of the regression coefficients for young biologically-related children are suprisingly similar. The regressions of biologically-related children on measures of their family background are found to be rather stable across samples and greatly inflated by the shared genetic variance in families.

One could argue that the range of environments sampled here is not sufficiently great to bear the weight of any conclusions about the effects of environmental variation in the population. Our counterargument is twofold. First, the comparison with similarly-sampled biological families reduces the force of the argument. Second, the coefficients of the biological families are much like those in other studies with more representative samples.

Even if differences in several demographic measures of family environments do not contribute much to differences in offspring's IQ scores, however, one must not conclude that the levels of environments in general make no difference for the development of intelligence. Obviously, the average performance level of the adopted children depends on the average value of their environments. In this sample, the average level of the environments is above average, and so is the average IQ level of the unrelated children. Presumably, if they had been reared in below-average homes, their average IQ levels would also be below average.

The average IQ of 106 for the adopted children can be partially explained by selection and partially by SES advantages. First, children who obviously are damaged or genetically defective are less likely to be placed for adoption. If agencies eliminated from the pool of potential adoptees all of the retarded, possibly 3% of the population with a mean IQ of 60, the average IQ score of the adoptable 97% would be 101. Second, if the actual regression of adopted children's IQ scores on family demographic variables is used to predict IQ improvement, an R of .138 yields 2.1 IQ points. Thus, the adoptees would be predicted to have an IQ average of 103.1, not 106.2, given an SES advantage one standard deviation above the population mean. By the same token, the average IQ scores of the biological children would be predicted from SES alone to be 104.9. With the addition of their genetic advantage, the average IQ of biological family adolescents should be 108.0. This is 4.8 points below their obtained average IQ of 112.8. Where do the extra three to five points come from?

One hypothesis is that SES is not a perfect indicator of the child rearing advantages enjoyed by families who volunteer for social science research; they also are above average in their interest in their children. Since we have no reason to believe that working-class families are on the average less interested in their children's welfare than professional families, volunteers would not bias the *slope* of the SES regression but would affect the intercept. Another hypothesis is that the regression of child IQ on family characteristics is not linear over its entire range. In the range we measured, from working to upper middle class, the slope is relatively flat, but it falls off sharply in the lower SES groups. Based on the obvious negative effects of very impoverished environments on children's development we prefer the latter, although our data will not discriminate the two hypotheses.

The Evidence on Individual Differences as Genes and Environments

From our family studies, the evidence of *some* genetic individual differences in IQ is simply overwhelming. Especially if one considers the past literature, there are literally dozens of studies that support that mild conclusion. When one attempts to get quantitative about proportions of genetic variance in IQ scores, one has to establish a range of probable values rather than any point estimate. There are several reasons for this. First, there may be real developmental differences in the degree to which environmental influences are potent determinants of individual differences. It seems from limited evidence that younger children may resemble their parents more on environmental grounds, because they are more exclusively influenced by their parents before they are launched into the world of schools, social institutions, and many individual choices.

Second, different cognitive skills that are sampled by different measures, such as vocabulary compared with other skills, may be more or less environmentally influenced. Thus, different age groups using different measures may well get somewhat different results. And, third, there are all the measurement and reliability questions that pertain to any study of cognitive abilities.

Going straight to the heart of the matter, we think that most evidence points to a heritability for IQ of about .4 to .7, given that heritability here means the proportion of variance among individuals sampled in twin and family studies, which, as we have repeatedly noted, are not representative of lower SES, neglectful, or abusive environments. If one could include people with really poor environments, the proportion of environmental variance might rise; on the the other hand, the genetic variance also might be increased. It is hard to predict whether the proportions of variance would change or not, and in which direction.

It is important to note the lack of systematic, measured, environmental differences among the adolescents. This suggests that within a range of humane environments, from an SES level of working to upper middle class, there is little evidence for differential environmental effects. The average level of these environments is such that the children perform intellectually somewhat above the population average, even though they have average biological parents. Thus, the environments sampled in family studies are better than average at fostering intellectual development. But why are the relatively poor families rearing adopted children whose IQ scores are nearly as high as those in professional families? It must be that all of these seeming environmental differences that predict so well the outcome differences among biological children are not primarily *environmental* differences, but indices of genetic differences among the parents and their biological offspring. This brings us to social class.

The Evidence on Social Class Differences as Genes and Environment

In 1938 Barbara Burks compared her California adopted and biological children with those studied by Alice Leahy in Minnesota. Grouping the children by the occupational status of their adoptive families, Burks computed the average effects of being born to and reared by, or only reared by, families at different locations in the social structure. As in all adoption studies, the families do not vary over the whole SES range; in fact adoptive samples always omit those lower portions of the income and educational distributions where big negative effects can occur. Nonetheless, it is interesting to examine the overall effects of being reared by a skilled working-class family, or a white-collar family, or a professional family. As we already know, the intellectual levels of parents in those groups differ on the average. What about the children?

For biological children of these occupational classes, the average difference between working-class and professional families was 12 IQ points in Burks's study and 17 IQ points in Leahy's. Children adopted by families of the same occupational classes, however, differed far less—about five IQ points in both studies. Adopted children in professional families scored below biological offspring; in working-class families, adoptees scored above the natural children; a very predictable genetic outcome. In our Minnesota studies, we found that the natural children of the transracial adoptive families averaged four to six IQ points above their adopted siblings (Scarr and Weinberg, 1976; 1977a). The adolescent adoptees averaged six IQ points below the biological children of comparably advantaged families. As in the other studies, there is a far greater relationship between parental social class and child IQ in the biological than adoptive families.

Since there is always some selective placement of adopted children into families that resemble their biological parents, the actual effect of differences in this middle to high range of social class environments may be less than the five or six IQ points cited. Again, let us emphasize that none of these studies speak to lower-class, deprived, abusive or any other kind of environmental abominations. We are only saying that in that portion of the SES range where so many studies report intellectual differences among children reared in such circumstances, the differences observed among the children may not be primarily of environmental origin at all. From the older studies, Burks (1938) estimated that genetic differences among the occupational classes account for about ⅔ to ¾ of the average IQ differences among the children born into those classes. Our studies support that conclusion.

If this had been a longitudinal study from the first year of the children's lives to the eighteenth, with detailed observations of the children's environments, the regression coefficients of adolescents' IQ scores on a better set of environmental variables may well have been higher. SES variables are far from perfect indices of children's experiences. Presumably, more of the total variance in adolescent IQ would have been accounted for, if better environmental measures had been available. The effect of such a change would be similar in the adoptive and biological families, since the environments of both were equally represented by the SES measures. Thus, the amount of variance explained by *measured* rather than unmeasured environments might be increased in both kinds of families, but the genetic variance estimated would remain the same.

Why Study Genetic Differences in Behavior?

Some readers may conclude that family research supports pessimistic conclusions. What is left to the systematic environment? (Much of the variance is still unexplained, of course!)

We do not see these research outcomes as pessimistic in the slightest. On the contrary, these family studies permit behavioral scientists and social policy makers to sort out important differences in people's environments. There are three major reasons why behavior genetic studies of families are useful.

The first, and weakest one for social policy, is that we need to gain a fuller understanding of the nature of human behavior. The naive environmentalism of the past three decades locked us into assumptions that are simply untenable, useless, and wrongheaded. The average layman had better intuitions about the nature of human differences than many social scientists purported to have. We have the suspicion, however, that most environmentalists privately explained behavioral differences much as the rest of the population does. But why should we continue to be publicly wrong?

The second reason for behavior genetic studies of families is more "relevant," to use a phrase of the sixties. These studies can and do provide diagnostic clues about the nature of some developmental problems. Just as a good family history in medicine and clinical psychology expresses a concern for individual risks, so tracing family patterns of behaviors affords us a look at human behavior in the making, and often a more optimistic prognosis. So, father was a hyperactive boy; today he is a successful business man. So, when mother was a child, she had a difficult time meeting new people; today she is a respected member of community groups. Social scientists can afford to have more respect for the individual patterns of development that make us different from one another. Biological diversity is a fact of life; respect for individual differences comes very much from that biological perspective, and is not a trivial victory.

Third, and most important to us, are the implications for intervention programs. In its baldest form, naive environmentalism has led us into an intervention fallacy. By assuming that all of the variance in behavior was environmentally determined, we have blithely promised a world of change that we have not delivered, at great cost to the participants, the public, and ourselves. The fallacy runs like this: if people who do X without our intervention have more desirable outcomes than people who do not do X, then we should persuade, or compel, all people to do X. This is unwise, because some of the reasons for the naturally-occurring differences between those who do and do not do X are not just environmental differences. Many of these seemingly environmental variations are actually genetic differences or gene-environment correlations. People who are different do things differently.

But here is the most costly part of the intervention fallacy: the erroneous belief that small variations in environments within the "humane range" have meaningfully different outcomes for children. If we observe that professional families take their children to the theatre more often than working-class families, or hang mobiles above their cribs more frequently, some social scientists feel justified in recommending to everyone that they take in plays frequently, rather than play baseball in the back yard, or hang mobiles over the crib, rather than carry the baby about wherever they go. Since these are the child-rearing practices of the professional class, whose children excel at IQ tests and in school, all parents are advised to alter their child-rearing practices to follow suit. *It has not been demonstrated that these variations in child rearing are functionally different in their effects on the children*, and we argue that most humane environments are in fact functionally equivalent. Behavior genetic studies of families can spare us all a homogeneity of environmental practices, imposed by an "omniscient" professional class.

We can do a better job of designing and implementing effective intervention programs, if we know which variations in the environment make a difference and which ones do not. We can shift our resources to the improvement of those circumstances that have clear, environmentally-deleterious effects on people. Many of these we know: we do not have to do research to know that hunger is not good for children, or that child abuse leaves scars. Most of the worst environments are obviously deleterious. But there are many other marginal and less obvious practices and conditions that we can judge only from sophisticated research on the effects of those environments. So, it is important to know what aspects of the environment have consequences for behavioral differences, and which ones are only apparent variations, based on cultural preferences, genetic differences or on gene-environment correlations. People deserve respect for self-expression and their own modes of child rearing, unless there is clear environmental reason to intervene. Behavior genetic methods will help us to gain a far clearer understanding of which environmental variables to worry about.

But, let us recall that *the average level of our environment is the most important determinant of the level of behavioral development*. Therefore, by providing better schooling, nutrition, health care, psychological services and the like, we can raise the average level of the environment and of behavioral development in the whole population. But some of you will argue that there are real dangers for social policy from research on individual and group differences. We see no necessary connections between the scientific results reported here and *any* social policy. Science is *not* politics, nor are social policies primarily dependent on scientific evidence, however much we might wish sometimes that they were. Policy matters depend mostly on values, and in this society, many groups compete over the translation of their values into policies.

Frankly, we think such pluralism is healthy, because as scientists we have no special wisdom in policy matters. Our unique gift to the society is the most objective look we can manage at the nature of the human condition. Hopefully, that information will be noticed and used to improve human lives. As citizens, we can try to be heard, so that our work will have the effects we personally value, but in doing so we must be very careful not to throw away our unique contribution—a set of methods and standards of truthfulness that distinguish us from many other groups.

CONCLUSION

The conclusion that we feel is justified by our data is that intellectual differences among children at the end of the child-rearing period have little to do with environmental differences among families that range from solid working class to upper middle class. These results have important implications for sociological and economic studies of the long range effects of family background on adult achievements. The persistent finding that differences in class background bias adult achievements has been interpreted to mean that differences in family environments during the child-rearing period enhance or impede the intellectual, educational, and occupational achievements of the offspring for a lifetime. From our data, it appears to us that these linkages should be reinterpreted to mean that differences in family background that affect IQ are largely the result of genetic differences among parents, which affect their own status attainments and which are passed on genetically to their offspring, whose status attainments are subsequently affected. The implications of these results are that social scientists should be very wary of interpreting the causes and effects of class differences in studies of biological families. We also should be sensitive to the genetic transmission of family characteristics.

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