

of the child's home environment based on environmental variables that previous research had established as correlates of IQ and scholastic achievement and which, overall, are intended to indicate the amount of intellectual stimulation afforded by the child's environment outside of school. Measures of the achievement and home environment variables were obtained on large samples of biologically full-sibling pairs ( $N_p = 579$ ), each tested twice (at ages 6.6 and 9.0 years). The total sample comprised three groups: white, black, and Hispanic, and represented the full range of socioeconomic levels in the United States, with intentional oversampling of blacks and Hispanics.

The data on each population group were treated separately, yielding three matrices (white, black, and Hispanic), each comprising the correlations between (1) the achievement and the environmental variables within and between age groups, (2) the full-sibling correlations on each variable at each age, and (3) the cross-sibling correlations on each variable at each age—yielding twenty-eight correlation coefficients for each of the three ethnic groups.

Now if, in addition to the environmental factors measured in this study, there were some unidentified Factor X that is unique to a certain group and is responsible for most of the difference in achievement levels between the ethnic groups, one would expect that the existence of Factor X in one (or two), but not all three, of the groups should be detectable by an observed difference between groups in the matrix of correlations among all of the variables. That is, a Factor X hypothesized to represent a unique causal process responsible for lower achievement in one groups but not in the others should cause the pattern of correlations between environment and achievement, or between siblings, or between different ages, to be distinct for that group. However, since the correlation matrices were statistically equal, there was not the slightest evidence of a Factor X operating in any group. The correlation matrices of the different ethnic groups were as similar to one another as were correlation matrices derived from randomly selected half-samples *within* each ethnic group.

Further analyses by Rowe et al. that included other variables yielded the same results. Altogether the six data sets used in their studies included 8,582 whites, 3,392 blacks, 1,766 Hispanics, and 906 Asians.<sup>[42a]</sup> None of the analyses required a minority-unique developmental process or a cultural-environmental Factor X to explain the correlations between the achievement variables and the environmental variables in either of the minority groups. The results are consistent with the default hypothesis, as explained by Rowe et al:

Our explanation for the similarity of developmental processes is that (a) different racial and ethnic groups possess a common gene pool, which can create behavioral similarities, and that (b) among second-generation ethnic and racial groups in the United States, cultural differences are smaller than commonly believed because of the omnipresent force of our mass-media culture, from television to fast-food restaurants.

Certainly, a burden of proof must shift to those scholars arguing a cultural difference position. They need to explain how matrices representing developmental

processes can be so similar across ethnic and racial groups if major developmental processes exert a minority-specific influence on school achievement. (p. 38)<sup>[42b]</sup>

The dual hypothesis, which attributes the within-group variance to both genetic and environmental factors but excludes genetic factors from the mean differences between groups, would, in the light of these results, have to invoke a Factor X which, on the one hand, is so subtle and ghostly as to be perfectly undetectable in the whole matrix of correlations among test scores, environmental measures, full-siblings, and ages, yet sufficiently powerful to depress the minority group scores, on average, by as much as one-half a standard deviation.

To test the hypothesis that genetic as well as environmental factors are implicated in the group differences, Rowe and Cleveland<sup>[42d]</sup> designed a study that used the kind of structural equation modeling methodology (with the biometric factor model) mentioned previously. The study used full-siblings and half-siblings to estimate the WGH for large samples of blacks and whites (total  $N = 1,220$ ) on three Peabody basic achievement tests (Reading Recognition, Reading Comprehension, and general Mathematics). A previous study<sup>[42c]</sup> had found that the heritability (WGH) of these tests averaged about .50 and their average correlation with verbal IQ = .65. The achievement tests were correlated among themselves about .75., indicating that they all share a large common factor, with minor specificities for each subtest.

The default hypothesis that the difference between the black and white group means on the single general achievement factor has the same genetic and non-genetic causes that contribute to individual differences within each group could not be rejected. The data fit the default model extremely well, with a goodness-of-fit index of .98 (which, like a correlation coefficient, is scaled from zero to one). The authors concluded that the genetic and environmental sources of individual differences and of differences between racial means appear to be identical. Compared to the white siblings, the black siblings had lower means on both the genetic and the environmental components. To demonstrate the sensitivity of their methodology, the authors substituted a fake mean value for the real mean for whites on the Reading Recognition test and did the same for blacks on the Math test. The fake white mean approximately equaled the true black mean and vice versa. When the same analysis was applied to the data set with the fake means, it led to a clear-cut rejection of the default hypothesis. For the actual data set, however, the BGH did not differ significantly from the WGH. The values of the BGH were .66 to .74 for the verbal tests and .36 for the math test. On the side of caution, the authors state, "These estimates, of course, are imprecise because of sampling variation; they suggest that a part of the Black versus White mean difference is caused by racial genetic differences, but that it would take a larger study, especially one with more genetically informative half-sibling pairs, to make such estimates quantitatively precise. . . ." (p. 221).

**Regression to the Population Mean.** In the 1860s, Sir Francis Galton discovered a phenomenon that he first called *reversion to the mean* and later gave