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ABSTRACT

It has been said that the heritability of learning ability or of intelligence is irrelevant to teachability. In support of this statement we see it pointed out that a child or a group of children show some response to training, and this is held up as evidence against the heritability of intelligence or learning ability. Most estimates of the heritability of IQ in the European and North American populations on which we have good data fall in the range from 0.60 to 0.90 and most of these estimates are in range from 0.70 to 0.80 (not corrected for test unreliability. The fact that IQ has high heritability surely does not mean that individuals cannot learn much. But knowing that learning ability has heritability does tell us this: if a number of individuals are all given equal opportunity--the same background, the same conditions, and the same amount of time--for learning something, they will still differ from one another in their rates of learning and consequently in the amount they learn per unit of time spent in learning. The fact that scholastic achievement shows lower heritability than IQ means that more of the variance in scholastic achievement is attributable to nongenetic factors than is the case for IQ. Consequently, we hypothesize what the sources of the environmental variance in scholasticachievement are, and , possibly we can manipulate them. (Author/JM)

Heritability and Teachability

Arthur R. Jensen

It has been said that the heritability of learning ability or of intelligence is irrelevant to teachability, or as the *Bulletin of the ERIC Information Retrieval Center on the Disadvantaged* (1969, 4, no. 4) printed in boldface: "Teachability is not a function of heritability." In support of this statement we see it pointed out that a child or a group of children show some response to training, and this is held up as evidence against the heritability of intelligence or learning ability.

Heritability (h^2) is a technical term in genetics which refers to the proportion of the population variance in a phenotypic characteristic or measurement that is attributable to genetic variation. It has also been called the coefficient of genetic determination. It can take any value from 0 to 1. It is not a constant but differs for different traits, different measurements, and in different populations. Its value can be estimated by a number of methods in quantitative genetics. Like any population statistic, it is subject to measurement error and sampling error. Since it is based essentially on the analysis of variance, it can tell us nothing at all about the causes of the particular value assumed by the grand mean of the population. It only analyzes the variance (or squared deviations) *about* the grand mean. And it tells us what proportion of this total variance is *genetic* variance and what proportion is *non-genetic*, i.e., due to environmental factors of all kinds and to errors of measurement. Most estimates of the heritability of IQ in the European and North American populations on which we have good data fall in the range from .60 to .90 and most of these estimates are in range from .70 to .80 (not corrected for t- t unreliability).

The fact that IQ has high heritability surely does *not* mean that individuals cannot learn much. Even if learning ability had 100% heritability it would not mean that individuals cannot learn, and therefore the demonstration of learning or the improvement of performance, with or without specific instruction or intervention by a teacher, says absolutely nothing about heritability. But knowing that learning ability has high heritability does tell us this: if a number of individuals are all given *equal* opportunity—the same background, the same conditions, and the same amount of time—for learning something, they will still differ from one another in their rates of learning and consequently in the amount they learn per unit of time spent in learning. That is the meaning of heritability. It does not say that individuals cannot learn or improve with

instruction and practice. It says that given equal conditions, individuals will differ from one another, not because of differences in the external conditions but because of differences in the internal environment which is conditioned by genetic factors. "Teachability" presumably means the ability to learn under conditions of instruction by a teacher. If this is the case, then it is true that heritability has nothing to do with teachability. But was this ever really the question? Has anyone questioned the fact that *all* school children are teachable? The important question has concerned *differences* in teachability—differences both among individuals and among subgroups of the population. And with reference to the question of *differences*, the concept of heritability is indeed a relevant and empirically answerable question.

We have heard it said that "teachability is not inversely related to heritability." Such a statement simply ignores the central fact that heritability deals with differences. The degree to which equal conditions of teaching or instruction will diminish individual differences in achievement *is* inversely related to the heritability of the "teachability" of the subject in question, and various school subjects probably differ considerably in heritability.

The fact that scholastic achievement shows lower heritability than IQ means that more of the variance in scholastic achievement is attributable to nongenetic factors than is the case for IQ. Consequently, we hypothesize what the sources of the environmental variance in scholastic achievement are, and possibly we can manipulate them. For example, it might be hypothesized that one source of environmental variance in reading achievement is whether or not the child's parents read to him between the ages of 3 and 4, and we can obviously test this hypothesis experimentally. Much of the psychological research on the environmental correlates of scholastic achievement have been of this nature. The proportion of variance indicated by $1 - h^2$, if small, does in fact mean that the sources of environmental variance are skimpy under the conditions that prevailed in the population in which h^2 was estimated. It means that the *already existing* variations in environmental (or instructional) conditions are not a potent source of phenotypic variance, so that making the best variations available to everyone will do relatively little to reduce individual differences. This is not to say that as yet undiscovered environmental manipulations or forms of intervention in the learning or developmental process cannot, in principle, markedly reduce individual differences in a trait which under ordinary conditions has very high heritability. By the same token, low heritability does not guarantee that most of the nongenetic sources of variance can be manipulated systematically. A multitude of uncontrollable, fortuitous microenvironmental events may constitute the largest source of phenotypic variance in some traits.

The heritability of individual differences and of group differences in scholastic performance in the total population are therefore relevant if we are at all interested in the causes of these differences. To say that heritability is trivial or irrelevant is to say also that the complement of heritability, $1 - h^2$, or the

proportion of variance attributable to non-genetic or environmental factors is also trivial. To dismiss the question of heritability is to dismiss concern with the causes of educational differences and their implications for educational practices. As I read it, what most educators, government officials, and writers in the popular press who discuss the present problems of education are in fact referring to is not primarily dissatisfaction with some *absolute* level of achievement, but rather with the large group *differences* in educational attainments that show up so conspicuously in our educational system—the achievement gaps between the affluent and the poor, the lower-class and the middle-class, the majority and the minority, the urban and the suburban, and so on. Educational *differences*, not absolute level of performance, are the main cause of concern. Whether we like to admit it or not, the problem of achievement differences today is where the action is, where the billions of dollars of educational funds are being poured in, where the heat is on, and where the schools are being torn apart. Are we not trying to understand more about the causes of these differences? But as Carl Bereiter (1970, p. 298) has commented: "It is necessary to avoid both the oversimplification that says if there are genetic group differences nothing can be accomplished through educational improvement and the oversimplification that says if group differences in IQ are environmentally caused they can be eliminated by conventional social amelioration. The possibility that cultural differences are related to heredity, however, adds force to the need for schools to come to grips with the problem of providing for cultural pluralism without separatism or segregation. This may well be the major policy problem facing public education in our time."

It is mistaken to argue that heritability has no implications for the probable effects of environmental intervention. Since $1 - h_i^2$ (h_i^2 is h^2 corrected for attenuation) is the proportion of trait variance attributable to environmental factors, the square root of this value times the *SD* of the "true score" trait measurement gives the *SD* of the effect of existing environmental variations on the particular trait. For IQ this is about six points; that is to say, a shift of one *SD* in the sum total of whatever nongenetic influences contribute to environmental variance (i.e., $1 - h_i^2$), will shift the IQ about six points. (There is good evidence that environmental effects on IQ are normally distributed, at least in Caucasian populations [Jensen, 1970b, 1971].) Thus the magnitude of change in a trait effected by changing the allocation of the existing environmental sources of variance in that trait is logically related to its heritability. This applies, of course, only to existing sources of environmental variance in the population, which is all that can be estimated by $1 - h_i^2$. It can have no relevance to speculations about as yet nonexistent environmental influences or entirely new combinations of already existing environmental factors. With respect to IQ, I believe Bereiter (1970) states the situation quite correctly: "What a high heritability ratio implies, therefore, is that changes within the existing range of environmental conditions can have substantial effects on the mean level of IQ in

the population but they are unlikely to have much effect on the spread of individual differences in IQ within that population. If one is concerned with relative standing of individuals within the population, the prospects for doing anything about this through existing educational means are thus not good. Even with a massive redistribution of environmental conditions, one would expect to find the lower quarter of the IQ distribution to be about as far removed from the upper quarter as before" (p. 288). Bereiter goes on to say: "A high heritability ratio for IQ should not discourage people from pursuing environmental improvement in education or any other area. The potential effects on IQ are great, although it still remains to discover the environmental variables capable of producing these effects."

Reaction Range of IQ

Heritability can be understood also in terms of what geneticists refer to as the reaction range of the phenotypic characteristic. In the case of intelligence, for example, this is the range through which IQ varies in the population due to nongenetic influences. It is best expressed in terms of probabilities under the normal curve. There is good reason to believe that the *effects* of nongenetic factors on IQ in the population are normally distributed in the IQ range above 60 (Jensen, 1970b). If the heritability of IQ is .80, say, then we can picture the phenotypic reaction range, and the total distribution of environmental effects on IQ, as shown in Figure 4-1. The shaded curve is the normal distribution of IQs in the population. If we remove the 80 percent of the variance due to genetic factors and leave only the 20 percent of variance due to nongenetic factors, we see in the unshaded curve the resulting total distribution of IQs for identical genotypes that express phenotypic IQs of 100 in average environmental conditions. You can see that this distribution ranges from about IQ 80 to IQ 120. (The unshaded curve's variance is only 20% of the shaded curve's variance.) This is the reaction range of IQ in populations in which the heritability of IQ is .80. Figure 4-2 shows the converse situation. Again, the shaded curve is the actual distribution of phenotypes. The unshaded curve is the distribution of genotypes when the environment is held constant or identical for all individuals. Under these conditions, the absence of any environmental variation shrinks the total variance by 20 percent. As Bereiter pointed out, this makes relatively little difference in the total distribution.

Going back to Figure 4-1, it should be emphasized that the reaction range shown here does not result entirely from what we may think of as "environment." Thus, I use the term nongenetic rather than environmental. By definition, for the geneticist what is not genetic is environmental. But environmental variance includes many more or less random effects with unknown, unpredictable, or (as yet) uncontrollable causes. Even identical twins reared together are

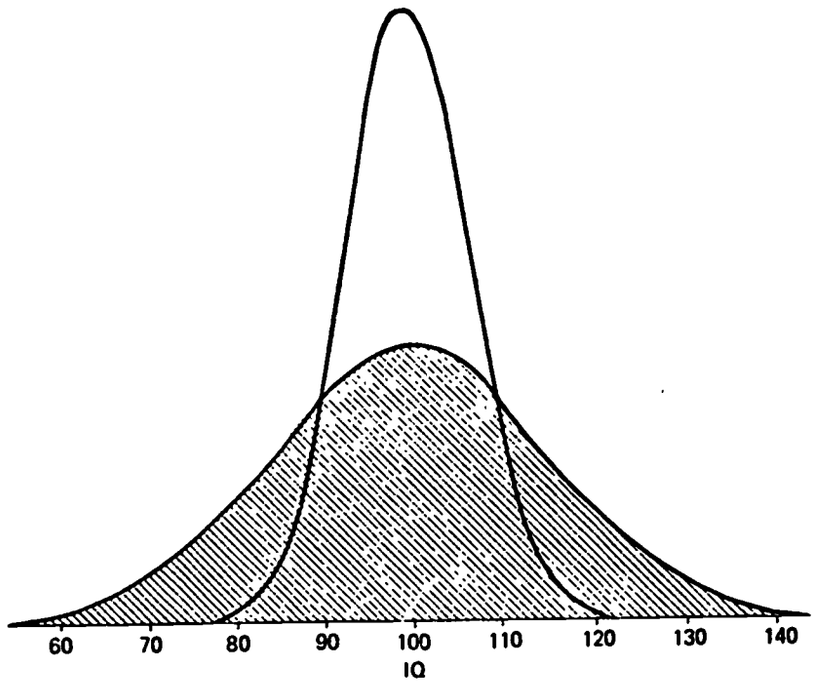

Figure 4-1. Comparison of Normal Distribution of IQs and Hypothetical Distributions with Genetic Variance Removed. Note: Shaded curve is distribution of IQs in population. Unshaded curve is hypothetical distribution if all genetic variance (when $h^2 = .80$) is removed.

not phenotypically identical. How realistic would it be to hope that all members of the population could be subject to as little environmental variance as identical twins reared together? The manipulable or equalizable aspects of the environment probably effect much less of the IQ variance than is suggested by our depiction of the total reaction range in Figure 4-1.

The largest IQ differences that have resulted from very extreme manipulations of the environment–extremes that very likely fall outside the limits of the middle 99 percent of the distribution of naturally occurring environments–have shown IQ changes of some 20 to 30 points. These changes have been observed only in very young children, with few, if any exceptions.

The important experiment of Dr. Rich Heber illustrates this reaction range concept of mental development. He has compared two groups of genotypically similar children in the Milwaukee ghetto, one group reared from birth in what may well be the lowest 1 or 2 percent of environmental conditions found in our society and the other group reared experimentally in the most mentally

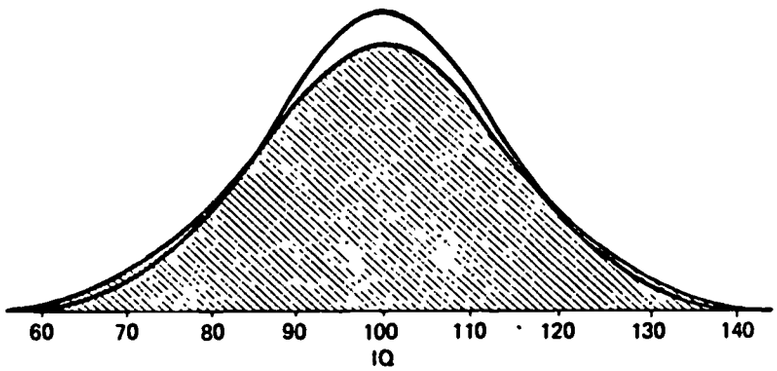

Figure 4-2. Comparison of Normal Distribution of IQs and Hypothetical Distribution with Environmental Variance Removed. Note: Shaded curve is distribution of IQs in the population. Unshaded curve is hypothetical distribution if all environmental variance were removed (when $h^2 = .80$).

stimulating environment that psychologists know how to devise; it is beyond the scale of naturally occurring environments. These two groups of children are now about five or six years old. Heber finds a magnitude of IQ differences between the groups of some 20 to 30 points, which is about what one might predict from our estimate of the reaction range of IQ when the heritability is .80. The Heber results have recently been held up in the popular press as evidence that genetic factors are of negligible importance, and some writers have even pointed to the Heber experiment as a refutation of "jensenism." Yet, interestingly enough, the results are within the range that would have been predicted from a genetic model assuming a heritability of .80.

The famous old study by Skodak and Skeels (1949) is repeatedly subjected to the same kind of misinterpretation by environmentalists who would like to deny the importance of genetic factors in causing intellectual differences. The Skodak and Skeels study is usually held up as an example of evidence which supposedly contradicts the high heritability of intelligence. The fact that the adopted children in the Skodak and Skeels study turned out to have considerably higher IQs than their biological mothers is thought to constitute a disproof of the conclusion from many heritability studies that genetic factors are more important than environmental factors (in the ratio of about 2 to 1) in the causation of individual differences in IQ. (Another way of saying this is that the heritability of intelligence is about .80, i.e., about 80 percent of the IQ variance is attributable to genetic factors. The 20 percent of the variance due to environmental differences can be thought of as a normal distribution of all the effects of environment on IQ, including prenatal and postnatal influences. This normal

distribution of environmental effects has a standard deviation of about 7 IQ points since the total variance of IQ in the population is $15^2 = 225$ and the 20 percent of this which is attributable to environment is .20 (225) = 45. the square root of which gives $SD = 6.71$.) Is there anything in the Skodak and Skeels data that would contradict this conclusion? Skodak and Skeels based their study on 100 children born to mothers with rather low IQs (a range from 53 to 128, with a mean of 85.7, *SD* of 15.8). The children were adopted into what Skodak and Skeels described as exceptionally good, upper-middle class families selected by the adoption agency for their superior qualities. Of the 100 true mothers, 63 were given the 1916 form of the Stanford-Binet IQ test at the time of the adoption. Their children, who had been reared in adoptive homes, were given the same test as adolescents. The correlation between the mothers' and children's IQs was .38. Now, the *difference* between the mothers' IQs and the children's IQs is not really the relevant question. Yet it is on this point that the interpretation of this study has so often gone wrong. What we really want to know is, how much do the children differ from the IQs we'd predict from a genetic model? Using the simplest model, which assumes that the children represent a random selection of the offspring of mothers having a mean IQ of 85.7 and are reared in a random sample of homes in the general population, the children's average predicted IQ would be 96. In fact, however, their average IQ turns out to be 107, or 11 points higher than the predicted IQ. If 20 percent of the IQ variance is environmental, and if one standard deviation of environmental influence is equivalent to about 7 IQ points, then it might be said that the Skodak and Skeels children were reared in environments which averaged eleven-sevenths or about 1.6 standard deviations above the average environment of randomly selected families in the population. This would be about what one should expect if the adoption agency placed children only in homes they judged to be at least one standard deviation above the average of the general population in the desirability of the environment they could provide. From what Skodak and Skeels say in their description of the adoptive families, they were at least one standard deviation above the general average in socioeconomic status and were probably even higher in other qualities deemed desirable in adoptive parents. So an eleven-point IQ gain over the average environment falls well within what we should expect, even if environmental factors contribute only 20% of the IQ variance. But this 11 IQ points of apparent gain is more likely to be an over-estimate to some extent, since these children, it should be remembered, were selected by the agency as suitable for adoption. They were not a random selection of children born to low IQ mothers. Many such children are never put out for adoption. (Most of the children were illegitimate, and as indicated in Leahy's (1935) study, illegitimate children who become adopted have a higher average IQ than illegitimate children in general or than legitimate children placed for adoption.) Even so, it is interesting that Skodak and Skeels found that the 11 adopted children whose true mothers had IQs below 70

averaged 25 points lower than the 8 adopted children whose true mothers had IQs above 105. There are also certain technical, methodological deficiencies of the Skodak and Skeels study which make its results questionable; these deficiencies were trenchantly pointed out many years ago in critiques by Terman (1940, pp. 462-467) and McNemar (1940). In summary, the Skodak and Skeels study, such as it is, can be seen to be not at all inconsistent with a heritability of .80 for intelligence.

Heritability and Individual IQs

Heritability is said to be a population concept because its value cannot be determined independently of the population. That is to say, it is a statistical construct. But does this mean that it is irrelevant when we consider an individual measurement, such as a score on an IQ test? No. The reliability of a test score is also a statistical construct, being the proportion of "true score" variance in the population of obtained scores. Now, just as the square root of a test's reliability coefficient tells us the correlation between obtained scores and true scores, so the square root of a test's heritability tells us the correlation between obtained scores (i.e., the phenotypes) and "genetic values" (i.e., genotypes) on the trait being measured. ("Value" refers here to a scaled quantity; it implies no "value judgment.") Without an absolute scale (as is the case for practically all psychological measurements), these values must be expressed merely as deviation scores, i.e., as deviations from a population mean. For the "genetic value" to have any valid meaning, it must be expressed (and interpreted) as a deviation from the mean of the population in which the heritability was estimated and also in which the individual in question is a member. Given these conditions, we can determine the standard error of a test score's "genetic value," analogous to the standard error of measurement. (The analogy is not perfect, however, since true scores and measurement errors are by definition uncorrelated, while genetic (G) and environmental (E) components may be correlated. But this is a soluble problem. The covariance of G and E can be independently estimated and may or may not be included in the estimates of h^2, depending upon the interpretation one wishes to give to h^2. Roberts (1967, pp. 217-218) has suggested that the environment should be defined as affecting the phenotype independently of the genotype. Thus, if individuals' genotypes influence their choice of environments, the environmental variation resulting therefrom would be considered a part of the total genetic variance.) It is simply $SE_G = SD\sqrt{1 - h^2}$, where SE_G is the standard error of the genetic value, SD is the standard deviation of the test scores, and h^2 is the heritability (not corrected for attenuation due to test unreliability). For IQ, assuming $SD = 15$ and $h^2 = .75$, the standard error of the genetic value is 7.5 IQ points. This can be interpreted the same as the standard error of measurement. It means that 68% of our estimates of individual's genetic

values will differ less than 7.5 points from this phenotypic IQ, 95% will differ less than 15 (i.e., 2 SE_G's), and 99.7% will differ less than 22.5 points (3 SE_G's). In other words, the probability is very small that two individuals whose IQs differ by, say, 20 or more points have the same genotypes for intelligence or that the one with the lower IQ has the higher genetic value. The individual's estimated genetic value, $\hat{G}_i$, expressed as a deviation score, is $\hat{G}_i = h^2 (P_i - \bar{P}_P) + \bar{P}_P$ where P_i is the individual's phenotype measurement (e.g., IQ), and $\bar{P}_P$ is the population mean.

The statement that an individual's test score is within, say $\pm x$ points of his "true score" with a probability p is no less probabilistic than saying his test score is within $\pm x$ points of his "genetic value," with a probability p. In the individual case, of course, we may be able to take account of a variety of other information in addition to the individual's test score in order to obtain a more accurate assessment. Such adjustments in individual assessments, as Burt (1958) has indicated, can increase the heritability of the scores and consequently reduce the standard error of estimate of individual genotypic values. The use of less culture-loaded tests could have a similar effect.

Heritability and Group Differences

I have been falsely accused of claiming that the high heritability of IQ inevitably means that the mean differences in IQ between social class groups and racial groups must be due to genetic factors. I have never made this incorrect inference. What I have said is this: While it is true, indeed axiomatic, that heritability *within* groups cannot establish heritability *between* group means, high *within* group heritability increases the a priori likelihood that the *between* groups heritability is greater than zero. In nature, characteristics that vary genetically *among* individuals within a population also generally vary genetically *between* different breeding populations of the same species. Among the genetically conditioned traits known to vary between major racial groups are body size and proportions, cranial size and cephalic index, pigmentation of the hair, skin, and eyes, hair form and distribution on the body, number of vertebrae, fingerprints, bone density, basic metabolic rate, sweating, fissural patterns on the chewing surfaces of the teeth, numerous blood groups, various chronic diseases, frequency of dizygotic (but nonmonozygotic) twinning, male/female birth ratio, ability to taste phenylthiocarbomide, length of gestation period, and degree of physical maturity at birth (as indicated by degree of ossification of cartilage). In light of all these differences, Spuhler and Lindzey (1967) have remarked "... it seems to us surprising that one would accept present findings in regard to the existence of genetic anatomical, physiological, and epidemiological differences between the races ... and still expect to find *no* meaningful differences in behavior between races" (p. 413). The high within

groups heritability of certain behavioral traits, such as intelligence, adds weight to this statement by Spuhler and Lindzey.

In fact, it is quite erroneous to say there is no relationship whatsoever between heritability *within* groups and heritability *between* group means. Jay Lush, a pioneer in quantitative genetics, has shown the formal relationship between these two heritabilities (Lush, 1968, p. 312), and it has been recently introduced into the discussion of racial differences by another geneticist, John C. DeFries (in press). This formulation of the relationship between heritability *between* group means (h^2_B) and heritability *within* groups (h^2_W) is as follows:

$$h^2_B \simeq h^2_w \frac{(1-r)\rho}{(1-\rho)r}$$

where:

h^2_B is the heritability *between* group means.

h^2_w is the average heritability *within* groups.

r is the intraclass correlation among *phenotypes* within groups (or the square of the point biserial correlation between the quantized racial dichotomy and the trait measurement).

ρ is the intraclass correlation among *genotypes* within groups, i.e., the within-group genetic correlation for the trait in question.

Since we do not know ρ, the formula is not presently of practical use in determining the heritability of mean group differences. But it does show that if for a given trait the genetic correlation among persons within groups is greater than zero, the between group heritability is a monotonically increasing function of within groups heritability. This is illustrated in Figure 4-3, which shows between groups heritability as a function of within group heritability for various values of the within-group genetic correlation when the mean phenotypic difference between the two groups involved is one standard deviation.

As I have pointed out elsewhere, other methods than heritability analysis are required to test the hypothesis that racial group differences in a given trait involve genetic factors and to determine their extents (Jensen, 1970c).

Analysis of Group Mean Differences

It may be instructive to express the magnitude of the differences between group means in terms of *within-group* environmental effects on the trait in question, which can be estimated from heritability analysis. For illustrative purposes I shall use the heritability value for IQs obtained from the combined studies of

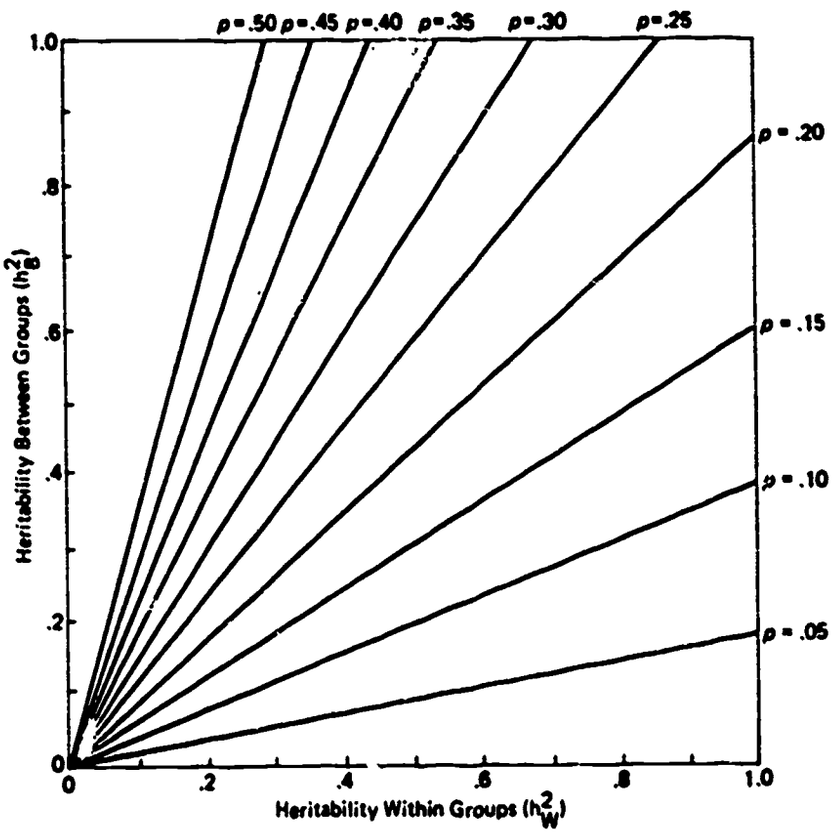

Figure 4-3. Heritability Between and Within Groups for Different Within Group Genetic Correlations. Note: Heritability between groups as a function of average heritability within groups for different values of within-group genetic correlation (ρ) for two populations which differ phenotypically by one standard deviation.

identical twins reared apart (Jensen, 1970b). For the sake of simplicity in this illustration, I will assume the same heritability in white and black populations. This is not a necessary assumption and in practice we would obtain estimates of heritability in both populations. At this point I am focusing only upon the logic of a particular kind of analysis rather than making a case for the particular quantitative values involved. Also, I assume that the total variance is the same in both populations and that the environmental effects on IQ are normally distributed in both populations. This can be shown to hold true in the twin

samples in which heritability was determined, but in practice would of course have to be empirically determined in both populations.

Figure 4-4 shows this kind of analysis. The top figure shows the total distribution of IQs in two populations with means of 85 and 100, respectively. The standard deviation, σ, in each group is 15 points. The middle set of curves show the shrunken distribution of IQ when the genetic variance in each population is eliminated. Thus, while the groups differ phenotypically by 1σ (upper curves), they differ in terms of total environmental effects on IQ by 3.2σ. The standard deviation of environmental effects (with error of measurement removed) within groups is only 4.74 IQ points. But this represents the total nongenetic or environmental effect, much of which is "microenvironmental," i.e., unsystematic and unsusceptible to systematic control. If we regard environmental differences *within* families, such as birth order effects, and the like, as largely constituting this source of unsystematic microenvironmental variance, we can estimate it by appropriate methods and eliminate it statistically, leaving only the distribution of *between*-families environmental effects on IQ. This has a standard deviation of 3.35 IQ points and, as shown in the lower curves of Figure 4-4, the population mean difference can be expressed as a difference of 4.5σ of between-families environmental effects. These are the effects we are most likely to have in mind when we talk about changing environments. The between-families environmental effects are the systematic environmental differences we associate with socioeconomic status, nutritional conditions, child rearing practices, cultural advantages, and the like. It can be seen here that these effects as estimated from twin studies account for only a small part of the within-population variance (about 12%), and that if one were to explain all of the 15 IQ points differences entirely in terms of this source of environmental effects, it would have to be granted that the populations differ on a scale of these effects by 4.5σ. This is an enormous difference, implying almost no overlap between the two populations in the distribution of systematic environmental effects on IQ. A warranted conclusion would be that it is highly improbable that the group mean difference is entirely attributable to the environmental variations that make for differences between separated twins reared in different families. To argue otherwise would require us to believe that on a scale of environmental effects the average black is reared under conditions 4.5σ below those of the average white twin. If we call the latter's environment about average for the white population, we would conclude that the *average* black environment is 4.5σ below this level, that is, something below the 0.003 percentile of systematic environmental effects on IQ in the white population. This strongly suggests that if one is to explain the average 15 point black IQ deficit in wholly nongenetic terms, it will probably be necessary to posit some environmental factors other than those we normally think of as the environmental factors affecting intelligence in the white population. Moreover, if the heritability of IQ is not appreciably different in the black and white populations, these hypothesized

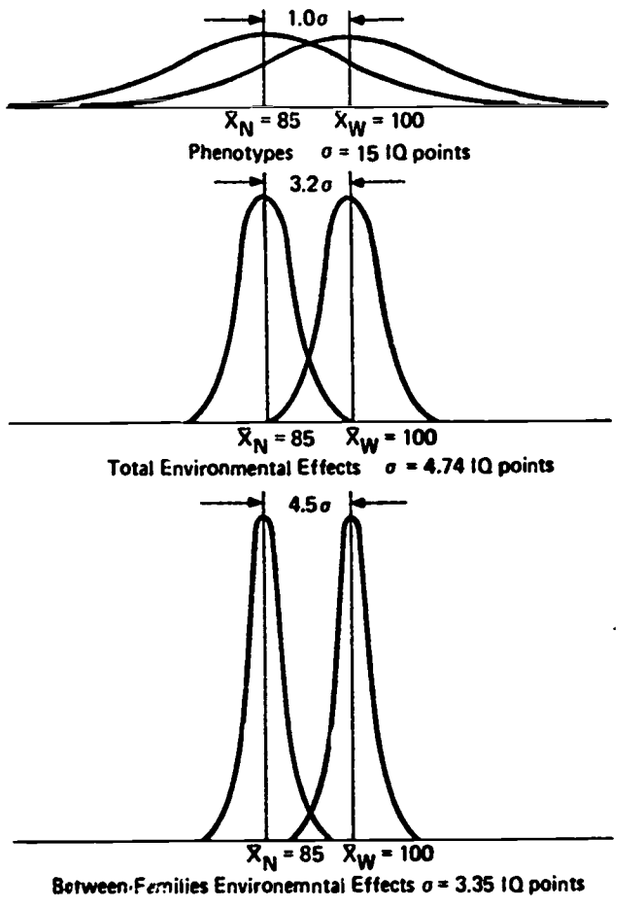

Figure 4-4. IQ Distributions with Genetic and Environmental Effects Removed. Note: The top curves represent two IQ distributions each with σ = 15 IQ points and the means differing by 15 points or 1 σ. The middle set of curves show the effect of removing all genetic variance, leaving only the total environmental variance; the means then differ by 3.2σ of total environmental effects. The lower curves show the effect of removing both the genetic and the within-families environmental variance, leaving only between-families environmental variance; the means then differ by 4.5σ of between-families environmental effects. The area under all curves is the same.

environmental effects responsible for the lower average black IQ would have to be assumed to produce little or no variance *within* the black population, unless one wanted to assume that virtually none of the environmental proportion of IQ variance *within* the black population was attributable to the same kinds of environmental effects that contribute to environmental variance in the white population. Such an entirely cultural explanation would seem to make the black population too incredibly different. The amount of genetic difference that would have to be hypothesized to explain what we already know is quite small as compared with the fantastically great environmental and cultural differences between the American black and the white populations that must be hypothesized in order to maintain a wholly nongenetic theory. The average amount of genetic difference that would have to be hypothesized to explain the data is about the same as the average difference in genotypic IQs between ordinary siblings in the same family. Do parents view this as such an awful difference among their own children? Yet this is about the amount of difference that would need to be hypothesized by a genetic theory for all that we now know about black-white IQ differences to be accounted for. How else essentially does science advance our knowledge than by trying out various hypotheses for how well they accord with the evidence?

The storm of criticisms that have been leveled at me has been a result of my expressing serious *doubts* that this racial IQ difference is entirely explainable in terms of culture-bias in tests, unequal educational opportunities, social discrimination, and other environmental influences. My position is that there is now sufficient evidence to seriously question the 100 percent environmental theories of the mean white-black intelligence difference. Are there any responsible scientists today who claim that this position can be ruled out on the basis of evidence or ruled out a priori by any principle of genetics? How many scientists today express little or no doubt that all of the racial IQ difference is attributable to environment? And on what evidence do those who claim no doubt base their certainty? I have not found any 100% environmental theory which can explain the facts or which stands up when its major premises are critically examined in the light of evidence. Therefore, I regard this issue scientifically as an open question which can be eventually answered in a scientific sense only if we are willing to consider all reasonable hypotheses. It is a reasonable hypothesis that genetic factors are involved in the average white-black IQ difference, and my study of the research evidence bearing on this question leads me to believe that a preponderence of the evidence is more consistent with a genetic hypothesis, which, of course, does not exclude the influence of environment.

Heritability in the Black Population

Unfortunately, we still have no adequate estimates of the heritability of intelligence in the black population, although two interesting studies have made

a beginning in this direction (Nichols, 1970; Scarr-Salapatek, 1971). The statistical problems and the nature of the data in both studies make their results quite tentative, but essentially they found that the heritability of the mental test scores are about the same in the black and white samples or possibly slightly lower in the black group, and definitely lower in the lower social classes of both racial groups. Scarr-Salapatek's results have been misrepresented in some popular accounts (e.g., *Psychology Today*, March 1972, p. 20) as refuting my position. Nothing could be further from the truth. In fact, one of the main points about black-white differences that I made in my *HER* (1969) article finds impressive support in Scarr-Salapatek's study. Scarr-Salapatek emphasizes the point that the heritability of the mental tests is less in her lower social class groups of both races than in the middle-class groups. This fact she apparently interprets as being consistent with an explanation of the mean black-white IQ differences in terms of environmental factors such as cultural deprivation. She states: "The lower mean scores of disadvantaged children of both races can be explained in large part by the lower genetic variance in their scores" (p. 1293). She adds: "If most black children have limited experience with environmental features relevant to the development of scholastic skills, then genetic variation will not be as prominent a source of individual phenotypic variation; nor will other between-family differences such as SES [socio-economic] level be as important as they are in a white population" (p. 1294).

The data shown in Scarr-Salapatek's Table 3 (p. 1288), however, make this interpretation extremely questionable. These data allow comparison of the mean scores on the combined aptitude tests for black children whose parents' level of education and income are both *above* the median (of the black and white samples combined) with the mean scores of white children whose parents' education and income are both *below* the common median. The lower status white children still score *higher* than the upper status black children on both the verbal and the non-verbal tests. Although non-verbal tests are generally considered to be less culture-biased than verbal tests, it is the non-verbal tests which in fact show the greater discrepancy in this comparison, with the *lower* status whites scoring higher than the *upper* status blacks. But in this comparison it is the upper status black group that has the higher heritability (i.e., greater genetic variance) on both the verbal and non-verbal tests. Thus the lower heritability which Scarr-Salapatek invokes to infer that blacks' generally poorer performance is attributable to environmental deprivation applies to the lower status white group in this particular comparison. Yet the lower status white group outperforms the upper status black group, which has the highest heritability of any of the subgroups in this study (see Table 9, p. 1292).

Is this finding more difficult to reconcile with a strictly environmental explanation of the mean racial difference in test scores than with a genetic interpretation which invokes the well-established phenomenon of regression toward the population mean? In another recent article in *Science* (1971, p.

1226), Scarr-Salapatek clearly explicated this relevant genetic prediction, as follows:

> Regression effects can be predicted to differ for blacks and whites if the two races indeed have genetically different population means. If the population mean for blacks is 15 IQ points lower than that of whites, then the offspring of high-IQ black parents should show greater regression (toward a lower population mean) than the offspring of whites of equally high IQ. Similarly, the offspring of low-IQ black parents should show less regression than those of white parents of equally low IQ.

In other words, on the average, an offspring genetically is closer to its population mean than are its parents, and by a fairly precise amount. Accordingly, it would be predicted that upper status black children should, on the average, regress *downward* toward the black population mean IQ of about 85, while lower status white children would regress *upward* toward the white population mean of about 100. In the downward and upward regression, the two groups' means could cross each other, the lower status whites thereby being slightly above the upper status black. Scarr-Salapatek's data (Table 3) are quite consistent with this genetic prediction. Scarr-Salapatek's finding is not a fluke; the same phenomenon has been found in other large-scale studies which I pointed out in my *HER* (1969) article (pp. 83-84).

Controlling for Social Class

In the past year two widely publicized studies, one by George W. Mayeske and the other by Jane Mercer, have claimed that racial differences in intelligence and scholastic achievement can be explained entirely in terms of the environmental effects of the lower socioeconomic status of blacks in the United States. They showed that by statistically controlling a large number of social variables associated with socioeconomic status, they were able to "explain" practically all of the achievement gap between blacks and whites. This procedure is what I have termed the "sociologist's fallacy." It is based on the unwarranted and untenable assumption that all the socioeconomic and environmental variables on which the racial groups have been matched or statistically equated are direct *causal* factors, when in fact they are merely *correlates* of IQ. If some part of the SES difference within racial groups has a genetic basis, then statistically equating racial groups on social class equates them also to some degree on the genetic factors involved in intelligence. Indeed, it is theoretically conceivable that if one equated racial groups on a large enough number of *correlates* of IQ, one could statistically eliminate all of the IQ difference between them. But it would prove nothing at all about the *causes* of the mean IQ difference between the total populations. Many environmental indices are undoubtedly correlated with genotypes. Educational

level of the parents, for example, is often included as an environmental variable affecting the child's development. But it almost certainly includes also some genetic component which is common to both the parents and their children. If the environmental variables used for statistical control account for more of the IQ variance *within* racial groups than the complement of the heritability (i.e., $1 - h^2$) within the groups, then it is virtually certain that the environmental indices also reflect correlated genetic factors. Controlling SES thus partials out too much of the difference between the racial groups. Matching for SES, in short, matches not only for certain environmental factors but also for genetic factors as well. It is interesting also that when such matching is carried out, it is noted that the average skin color of the black groups becomes lighter in the higher SES categories, indicating that genetic factors covary with SES, for whatever reason. Genetic SES intelligence differences are firmly established within the white population. Matching black and white groups on SES, therefore, is certain to minimize genetic as well as environmental differences. For this reason, studies that control for SES are probably biased in favor of the environmentalist hypothesis and can contribute nothing to elucidating the nature-nurture problem.

Several lines of evidence support with a high level of confidence the conclusion that social classes, on the average, differ to some degree in the genetic factors involved in intellectual development. Social classes may be viewed as Mendelian populations that have diverged genetically. When the population is stratified into five or six socioeconomic status (SES) categories, mainly according to occupational criteria, the mean IQs of the *adults* so classified, from the highest SES category (professional and managerial) to the lowest (unskilled labor), span a range of some 30 to 40 points. The standard deviation of IQs *within* SES groups averages about 9 or 10 points for the adult population, as compared with $SD = 15$ for the whole population. Children born into these SES groups, on the other hand, show a mean IQ difference, from the lowest to the highest class, of only 20 to 30 points; and the SD *within* classes for children is about 13 or 14 IQ points, which means there is almost as much IQ variation among children *within* social classes as we find in the total population.

The cause of the higher degree of correlation between SES and IQ among adults than among children is the high level of social mobility in each generation. In England and in the United States, more than 30% of the adult generation are found to be of a different SES than that of their own parents (Burt, 1961; Gottesman, 1968; Maxwell, 1969). In each generation some individuals move up in SES and some move down. Those who move up have higher IQs, on the average, than those who move down.

Since the heritability, h^2, (i.e., the proportion of genetic variance) of IQ in the total population is between .70 and .80, and since the correlation between phenotypes and genotypes is the square root of the heritability, it follows that the IQ estimates genotypic intelligence with a reliability of between $\sqrt{.70}$ and $\sqrt{.80}$, i.e., between about .84 and .89 (Jensen, 1967; 1969). Conversely, the

reliability with which IQ measures the *non*-genetic component of intelligence variation is $\sqrt{1 - h^2}$, or between about .45 and .55. If only nongenetic factors determined individuals' SES, then the maximum correlation that could exist between SES and IQ would be in the range of .45 to .55. In fact, however, the correlations generally found are between .30 and .50 for children and between .50 and .70 for adults (depending largely upon how fine-grained the SES measure is). Now, if the correlation between IQs and genotypes is between .84 and .89, and the correlation between IQ and SES is between .50 and .70, the correlation between SES and genotypes must be greater than zero. To maintain a strictly environmental hypothesis, at the very least one would have to assume that only the environmental component of intelligence played a part in persons' educational and occupational attainments (the chief determinants of SES). If we admit no genetic component in SES differences in IQ and still admit the high heritability of IQ, we are logically forced to argue that persons have been fitted to their SES (meaning largely educational and occupational attainments) almost *perfectly* according to their environmental advantages and disadvantages, which constitute only 20 to 30 percent of the variance in IQ; and it would have to be argued that persons' innate abilities, talents, and proclivities play no part in educational and occupational selection and placement. This is a most unlikely state of affairs.

Consider other, more direct, evidence.

1. Adopted children show only about half as much dispersion in mean IQ as a function of SES of the adopting parents as that of children reared by their own parents (Leahy, 1935).
2. Children reared from infancy in an orphanage, with no knowledge of their parents, show nearly the same correlation between their IQs and their fathers' occupational status (graded into five categories) as children reared by their own parents (Lawrence, 1931).
3. Most of the IQ difference between siblings reared together is attributable to differences in genetic inheritance. (The genetic correlation between siblings is about .5 to .6.) When siblings who are reared together move into different social strata as adults, it is the sib with the higher IQ who is more likely to move up and the sib with the lower IQ who is more likely to move down the SES scale (Gibson, 1970).
4. Sons whose IQs differ most from their father's IQ are more likely to change SES, the higher IQs moving up, the lower moving down (Young & Gibson, 1963). Waller (1971) found a correlation of 0.368 ± 0.066 between the father-son disparity in IQ (both tested as school children) and father-son disparity in SES as adults, when only the middle three of five SES classes were considered (since in Classes I and V mobility is restricted to only one direction).
5. Genetically identical twins who were separated in infancy and reared apart

in homes of different SES (over a range of six categories, from professional to unskilled), differ on the average by only 1 IQ point per each SES category difference, with a total range of about 6 IQ points difference between the highest and lowest SES categories (Burt, 1966). Compare this difference, in which genetic factors play no part, with the difference of 20 to 30 IQ points generally found between children in the lowest and highest SES classes.

All this evidence is highly consistent with a model of social mobility in which the genetic factors involved in mental ability, through the processes of segregation and assortment, become selected into somewhat differing gene pools in various social and occupational classes.

Environmentalist Hypotheses

Those environmentalist hypotheses of the black-white IQ difference which have been most clearly formulated and are therefore subject to empirical tests are the only ones that can be evaluated within a scientific framework. The most frequently cited environmentalist hypotheses which are sufficiently clear to put to an empirical test and which already have been put to a test have not proven adequate to the explanatory function they were intended to serve. A number of lines of such evidence casts serious doubt on purely environmental and cultural theories of the racial IQ difference.

Negative Correlations Between Environment and Ability

A number of environmental factors which correlate positively with mental ability *within* various population groups have been shown to correlate *negatively* with IQ differences *between* certain groups. On all of the many measurable factors which environmentalists have invoked to explain the black-white IQ difference, both American Indians and Mexican-Americans have been found to be much more disadvantaged than Negroes. Yet on non-verbal intelligence tests (which are more fair for bilingual groups such as Mexicans and Indians) and in scholastic performance, Indians and Mexicans significantly outperform blacks. This finding is neutral with respect to a genetic theory, in the sense that no prediction could have been derived from genetic principles: but it contradicts those environmental theories that invoke measurable environmental factors known to correlate with IQ within population groups as the cause of the lower black IQ. The only attempts of environmentalists to rationalize these findings have invoked highly speculative cultural and attitudinal factors which have not yet been shown to be correlated either with IQ or with race.

Culture-biased Tests

Intelligence tests can be rank-ordered according to certain generally agreed upon criteria of their cultural loading. Within a given culture, tests are better described as differing in *status fairness*. Environmentalists who criticize intelligence tests usually give as examples those tests which are most obviously loaded with what is presumably white, middle-class factual knowledge, vocabulary, and the like, as contrasted with more abstract figural material such as compose Raven's Progressive Matrices and Cattell's Culture-Fair Tests of *g*. Yet it is on the latter type of tests that blacks perform most poorly, relative to whites and other minority groups. Disadvantaged minorities, such as American Indians and Mexican-Americans, perform on tests showing different degrees of status bias in accord with the environmentalist hypothesis. Blacks do the opposite. "Translation" of tests such as the Stanford-Binet into the black ghetto dialect also does not appreciably improve scores.

The scholastic and occupational predictive validity of IQ tests is the same for blacks as for whites, and item analyses of tests showing large average group mean differences do not reveal significant differences in rank order of item difficulty or in choice of distractors for error responses. Test-taking attitudes and motivational factors appear unconvincing as an explanation of the group difference in view of the fact that on some tests which make equal demands on attention, persistence, and effort, such as various memory tests, blacks do perform quite well relative to whites. When various diverse tests and test items are ordered in terms of the degree to which they discriminate between blacks and whites, the one feature which is common to the most discriminating tests and items is the conceptual and abstract nature of the test material, or the degree to which they accord with the classic definitions of the psychological nature of *g*, the general factor common to all complex tests of mental ability.

In 1968 I proposed that the heritability of a test be considered as one objective criterion of the test's culture-fairness or status fairness (Jensen, 1968). Since then, M.B. Jones (1971) also has advocated the use of heritability as a criterion in psychological test construction. I also suggested that one might test competing genetic and environmental hypotheses of a particular group difference by comparing the performance of the two groups in question on tests which differ in heritability. The environmental hypothesis should predict a smaller mean difference between the groups on those tests with the higher heritability than on tests with lower heritability; a genetic hypothesis would predict just the opposite. So here we have the possibility of strong inference, since the two competing theories are pitted against each other in yielding opposite predictions.

To see the rationale of this kind of hypothesis, consider the fact that various mental tests differ in their sensitivity to environmental influences. For example, a test which is very sensitive to reflecting environmental influences will show

smaller differences between genetically dissimilar and unrelated children who have been adopted and reared together in the same home than between genetically identical twins who have been separated in infancy and reared apart in different homes. Such a test which strongly reflects environmental influences has low heritability. On the other hand, a test with high heritability (or low sensitivity to environmental effects) will show larger differences between unrelated children reared together than between identical twins reared apart.

In order to obtain statistically reliable estimates of the environmental sensitivity of tests I used siblings rather than twins, because siblings are much more plentiful. We identified all siblings in grades K to 6 in an entire California school district. A variety of 16 mental tests of abilities and achievement, many of them standard tests, were administered to the eight thousand children in the study, and the correlations among siblings (r_s) were obtained on each test. Now we know that if only genetic factors were involved in the test variance, the sibling correlation should be very close to .50. (This is the sibling correlation, for example, for number of fingerprint ridges, which, we know, are virtually unaffected by environmental factors.) Any departure of the correlation from .50, above or below, therefore, is an indication of environmental variance. So we can employ as an index of environmental influence, E, on test scores the absolute difference from .50 of the obtained sibling correlation, thus $E = | r_s - .50 |$. This E index was obtained for white siblings and for black siblings. Next we obtained the mean white-black difference on each test, and to put the differences all on the same scale of standard scores, the mean difference was divided by the standard deviation of the tests' scores in the white sample. Thus, on every test the mean white-black difference was expressed in white standard deviation units. We then obtained the correlation and regression lines of the mean difference on the environmental sensitivity index for whites and for blacks. An environmentalist hypothesis should predict a positive correlation. In fact, however, the correlations are negative and statistically significant in both the white and Negro groups. The negatively sloping regression lines are shown in Figure 4-5. The correlation between the black and white values of the E index is .71 ($p < .01$). This means that the various tests are quite similar for whites and blacks in the degree to which they reflect nongenetic influences. The correlation between the black-white difference and the E index is $-.80$ ($p < .01$) for whites and $-.61$ ($p < .01$) for Negroes. Clearly, the results are more in accord with a genetic hypothesis than with a cultural hypothesis as an explanation of the mean white-black differences on the various tests. It should be noted that in general the scholastic achievement tests are more sensitive to environmental influence than the standard intelligence tests.

Is this finding merely a result of the particular selection of tests used in this study? I doubt it. The essential design has been replicated by Nichols (1970) at the University of Minnesota. Nichols used an entirely different battery of tests comprised mostly of the various subtests of the Wechsler Intelligence Scale for

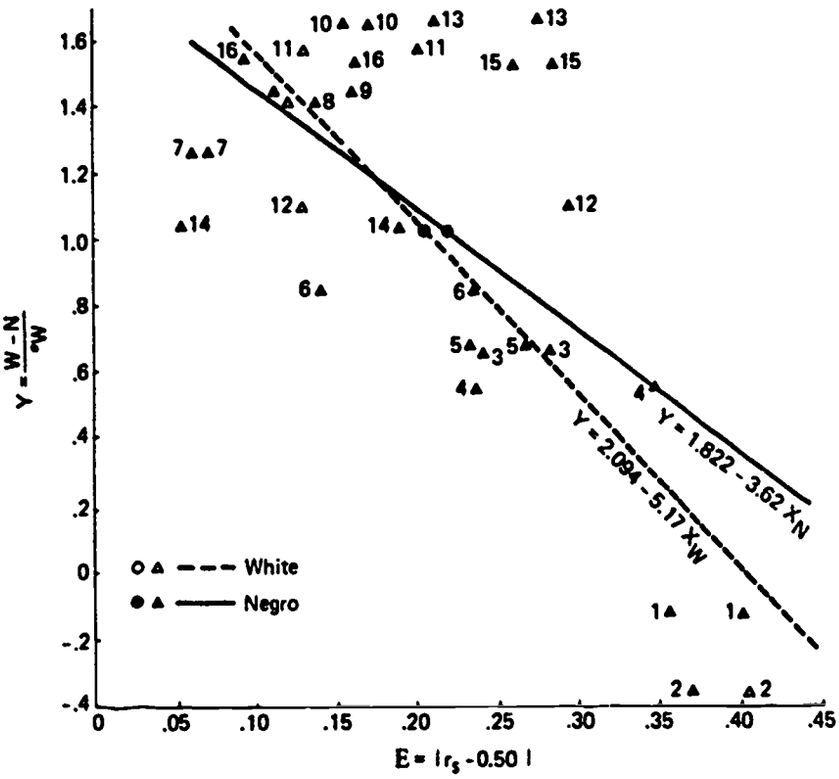

Figure 4-5. Regression of Black and White Differences on Environmental Index for Various Ability Tests. Note: The regression lines (for whites and Negroes) showing the mean white-Negro difference in white sigma units (Y) on 16 ability tests (numbered 1 to 16) as a function of the absolute difference from 0.50 of the sibling correlation for each test (X). Circles indicate the bivariate means; triangles indicate the various tests, which are numbered as follows: 1. Making X's (Neutral instructions); 2. Making X's (Motivating instructions); 3. Memory – Immediate recall; 4. Memory – After repetition; 5. Memory – Delayed recall; 6. Figure Copying; 7. Lorge-Thorndike IQ, Levels I and II (Pictorial); 8. Lorge-Thorndike, Verbal IQ; 9. Lorge-Thorndike, Nonverbal IQ; 10. Stanford Achievement: Word Meaning; 11. Stanford Achievement: Paragraph Meaning; 12. Stanford Achievement: Spelling; 13. Stanford Achievement: Language (Grammar); 14. Stanford Achievement: Arithmetic Computation; 15. Stanford Achievement: Arithmetic Concepts; 16. Stanford Achievement: Arithmetic Applications.

Children as well as several other tests (e.g., Bender-Gestalt, Illinois Test of Psycholinguistic Abilities, Draw-A-Man, and three scholastic achievement tests). Nichols used black and white sibling correlations to obtain an estimate of heritability for each test; this corresponds closely to the complement of our E index, i.e., I – E. So in Nichols' study the genetic hypothesis would predict a positive correlation between the racial difference (again expressed in standard deviation units) and the heritability of the tests. The correlation obtained by Nichols was +.67 (the average for whites and blacks). The correlation of socioeconomic status differences with heritability was +.86, which is consistent with the hypothesis of a high degree of genetic variance in SES differences in mental abilities. Two independent large-scale studies, therefore, have yielded results that are strikingly more consistent with a genetic than with an environmentalist hypothesis. I know of no other way that scientific investigation can proceed in this field at the present time than by testing a variety of hypotheses in this fashion, one by one, and sizing up the converging lines of evidence. I have examined the most often repeated environmentalist hypotheses in the light of relevant evidence. I can here only briefly summarize some of my observations. All the points made in these summaries are fully documented in my forthcoming book, *Educability and Group Differences.*

Language Deprivation

This is an unconvincing explanatory hypothesis in view of the fact that blacks perform best on the most verbal parts of intelligence tests and poorest on the least verbal materials. All other disadvantaged minority groups within the American population show the opposite trend. Children who are born deaf are the most verbally deprived subjects we can study. They show marked verbal deficits on intelligence tests. Yet they perform at an average level on nonverbal tests, thus showing a pattern of abilities opposite to that of blacks.

Another important difference between low SES children and children who are verbally deprived because of deafness is that while the former begin to lag in linguistic and intellectual development after beginning school, the latter show a gradual catching up to the average level as they progress in school—it merely takes them longer to acquire information because of their severe sensory handicap. But once it is acquired, normal mental development ensues. A study of the developing conceptual capacities of the deaf concluded "... the differences found between deaf and hearing adolescents were amenable to the effects of age and education and were no longer found between deaf and hearing adults. Dissociation between words and referents, verbalization adequacy, and (conceptual) level of verbalization were not different for deaf and hearing subjects. Our experiments, then, have shown few differences between deaf and hearing subjects. Those found were shown to fall along a normal developmental line and

were amenable to the effects of increased age and experience, and education" (Kates, Kates, & Michael, 1962, pp. 31-32).

Poor Motivation

There is no consistent evidence that blacks are less motivated in a test situation than are other groups. Some groups (e.g., Indians) whose general educational aspirations and self-concepts are poorer than those of blacks actually perform better on tests and in school. Also, on performance tests specially devised to maximize the influence of motivational factors and to minimize the test's dependence upon abstract or complex cognitive functions which would involve *g*, blacks do not perform significantly below whites. The "expectancy" or "self-fulfilling prophecy" theory has not been empirically demonstrated, and when put to proper tests it has failed to be substantiated.

Non-cognitive Tests

Certain perceptual-motor tests such as choice reaction time and pursuit motor learning (which has a very high heritability) show large black-white differences even under very highly controlled experimental conditions, and the results are independent of the race of the tester. Moreover, the magnitude of the racial difference has been shown to be related to the degree of white admixture in the black sample as assessed by physical indices. If genetic racial differences in behavioral tests other than intelligence tests are admitted, by what principle can one exclude the same possibility for types of tests labeled as measures of intelligence? There is no reason why intelligence tests should be categorically excluded from the possibility of showing genetic race differences when such differences in other physical and behavioral traits can be found.

Nutritional Deficiencies

The fact that severe malnutrition, especially protein deficiency, during prenatal development and in infancy and childhood can impair mental as well as physical growth is not at issue. Studies from the nutritionally most deprived segments of populations in Africa, Mexico, and South America would support this conclusion. There are no data, however, which would support the hypothesis that malnutrition contributes any appreciable fraction to the average black-white IQ difference. In black communities where there is no evidence of poor nutrition, the average black IQ is still about 1 *SD* below the white mean. When groups of black children with IQs *below* the general black average have been studied for

nutritional status, no signs of malnutrition have been found. Physical evidence of malnutrition found to be correlated with lower IQs in studies conducted in Africa, Mexico, and Guatemala have not been found even in the poorest and lowest IQ segments of the American black population. On the basis of prese t evidence, the hypothesis that lower average black IQ is due to poor nutrition is not tenable.

The nutritional and health care status of Indian children, as indicated by much higher rates of infant mortality, is much poorer than that of blacks; yet Indian children in the first grade in school (age 6) have been found to score about one *SD* above blacks on nonverbal ability tests.

Prenatal and Perinatal Disadvantages

The higher rate of fetal loss and infant mortality in the black population may indicate disadvantages related to prenatal health care of the mother and undesirable conditions attending birth. These conditions prevail in the poorer segment of the black population and probably contribute to the incidence of neurological handicap among black children. All of the causes of high fetal loss, however, are not understood, for there are some relatively disadvantaged populations which have shown lower rates of fetal loss than is found in the white majority—Orientals, for example. There is now evidence that the degree of genetic heterogeneity of the fetus' ancestors is directly related to the probability of fetal loss, and thus genetic factors may be involved even in this seemingly environmental phenomenon. Disadvantaging forms of birth trauma such as anoxia, low birth weight and prematurity are reflected in subnormal performance on infant tests of perceptual-motor development. But large representative samples of black children show no depression of scores on these tests and generally perform at slightly higher levels than middle-class white children. Prenatal and perinatal factors, though differing in black and white populations, do not begin to account for such phenomena as the six times higher rate of mental retardation (IQs below 70) in the black than in the white population. Unless one hypothesizes the existence of genetic factors, in the vast majority of cases the causes of the mental retardation must be categorized as "unknown" or "unidentified."

Educational Implications

At present, neither I nor anyone else, I'm afraid, has any more than rather general notions concerning the educational implications of the wide range of apparent differences in educability in our population. Since the heredity-environment issue is not likely to reach a general consensus among qualified

scientists for quite some time to come and after much more genetical and psychological research has been completed, it is probably wise for educators to assume an openly agnostic position with regard to the genetic issue as it involves racial differences, at the same time recognizing that whatever may be the causes of the difference, we do not at present know of any measures or methods within the power of the schools that will appreciably or permanently diminish either individual or group differences in intelligence or scholastic achievement. There is fundamentally, in my opinion, no difference, psychologically and genetically, between individual differences and group differences. Individual differences often simply get tabulated so as to show up as group differences—between schools in different neighborhoods, between different racial groups, between cities and regions. They then become a political and ideological, not just a psychological, matter. To reduce the social tensions that arise therefrom, we see proposals to abolish aptitude and achievement testing, grading, grade placement, special classes for the educationally retarded and the academically gifted, neighborhood schools, the classroom as the instructional unit, the academic curriculum, and even our whole system of education. There may be merit in some of these proposals. But I think they are too often aimed at covering up problems rather than coming to grips with them. We can urge doing away with classification and groups, and enforce laws against racial discrimination in educational opportunities and employment and housing; we can and must insist upon considering only persons' individual characteristics rather than their group membership as a basis for educational treatment and in social relations in general. Well and good. I trust there is no disagreement on this. What we may not accomplish by these means, however, is equality of performance in school or in the acquisition of certain skills deemed valuable by society and rewarded accordingly. If we repeatedly look for the causes of differences in ability to acquire an educationally valued skill such as reading, for example, in the external environment and are hard put to find a convincing explanation there, but we also refuse to consider any other than external factors as possible causes of these differences, perhaps we only sow the seeds of a kind of social paranoia—a need to find strictly external causes to blame for the observed differences.

To seek the answers to these questions and yet to worry about their far reaching implications: surely this is the scientist's moral dilemma. I don't claim to have the solution.

In terms of what we now know in educational research and in terms of what seems immediately feasible, I would suggest further consideration of three main educational approaches. They are not at all mutually exclusive. (The desirability and necessity of eliminating racial discrimination and of generally improving the environmental conditions and educational and occupational opportunities of all disadvantaged persons in the population are taken for granted.) These approaches have nothing to do with race *per se*, but are concerned with individual differences in those characteristics most relevant to educability. Their success in

improving the benefits of education to black children, however, may depend in part upon recognizing that racial differences in the distribution of educationally relevant abilities are not mainly a result of discrimination and unequal environmental conditions. None of the approaches that seems to me realistic is based on the expectation of the schools' significantly changing children's basic intelligence.

Seeking Aptitude X Training Interactions

This means that some children may learn better by one method than by another and that the best method may be quite different for different children, depending on their particular aptitudes or other personological characteristics. It implies that the same educational goals can be accomplished to the same degree for children of different abilities provided the right instructional variations are found. This is merely a hope, and the relevant research so far gives little basis for optimism that such aptitude X training interactions will be found which can overcome to any marked degree the importance of IQ level for educability. But since this type of research has been underway only a few years, it is much too soon to discount the possibilities it may turn up--especially if one expects not miracles, but only positive, if modest, benefits from this approach.

Greater Attention to Learning Readiness

The concept of developmental readiness for various kinds of school learning has been too neglected in recent educational trends, which have been dominated by the unproved notion that the earlier something can be taught to a child, the better. Forced early learning, prior to some satisfactory level of readiness (which will differ markedly from one child to another), could cause learning blocks which later on practically defy remediation. The more or less uniform lock-step sequencing of educational experiences may have to be drastically modified for the benefit of many children, but the recent massive insistence on "earliness" and equality of educational treatment of all children has militated against large-scale research on the implications of readiness for children with below-average educability within the traditional school system.

Greater Diversity of Curricula and Goals

Public schools, which aim to serve the entire population, must move beyond narrow conceptions of scholastic achievement to find a greater diversity of ways for children over the entire range of abilities to benefit from their schooling--to

benefit especially in ways that will be to their advantage when they are out of school. The academic goals of schooling are so ingrained in our thinking and our values that it will probably call for radical efforts to modify public education in ways such that it will maximally benefit large numbers of children with very limited aptitude for academic achievement. I believe that a well-intentioned but misconceived social egalitarian ideology has prevented public education in the United States from facing up to this challenge.

The belief that equality of educational opportunity should necessarily lead to equality of performance, I believe, is proving to be a false hope. It is the responsibility of scientific research in genetics, psychology, and education to determine the basis for realistic solutions to the problems of universal public education. Though it may be premature to prescribe at present, I venture the prediction that future solutions will take the form not so much of attempting to minimize differences in scholastic aptitudes and motivation, but of creating a greater diversity of curricula, instructional methods, and educational goals and values that will make it possible for children ranging over a wider spectrum of abilities and proclivities genuinely to benefit from their years in school. The current zeitgeist of environmentalist equalitarianism has all but completely stifled our thinking along these lines. And I believe the magnitude and urgency of the problem are such as to call for quite radical thinking if the educational system is truly to serve the whole of society. We have invested so much for so long in trying to equalize scholastic performance that we have given little or no thought to finding ways of di ersifying schools to make them rewarding to everyone while not attempting to equalize everyone's performance in a common curriculum. Recommendations have almost always taken the form of asking what next we might try to make children who in the present school system do not flourish academically become more like those who do. The emphasis has been more on changing children than on revamping the system. A philosophy of equalization, however laudable its ideals, cannot work if it is based on false premises, and no amount of propaganda can make it appear to work. Its failures will be forced upon everyone. Educational pluralism of some sort, encompassing a variety of very different educational curricula and goals, I think, will be the inevitable outcome of the growing realization that the schools are not going to eliminate human differences. Rather than making over a large segment of the school population so they will not be doomed to failure in a largely antiquated elitist oriented educational system which originally evolved to serve only a relatively small segment of society, the educational system will have to be revamped in order to benefit everyone who is required by the society to attend school. It seems incredible that a system can still survive which virtually guarantees frustration and failure for a large proportion of the children it should intend to serve. From all the indications, public education in such a form will not much longer survive.

But we should not fail to recognize that to propose radical diversity in accord

with individual differences in abilities and interests, as contrasted with uniformity of educational treatment, puts society between Scylla and Charybdis in terms of insuring for all individuals equality of opportunity for the diversity of educational paths. The surest way to maximize the benefits of schooling to all individuals and at the same time to make the most of a society's human resources is to insure equality of educational opportunity for all its members. Monolithic educational goals and uniformity of approaches guarantee unnecessary frustration and defeat for many. On the other hand, educational pluralism runs the risk that social, economic, ethnic background or geographic origin, rather than each child's own characteristics, might determine the educational paths available to him. The individual characteristics appropriate for any one of a variety of educational paths and goals are to be found everywhere, in every social stratum, ethnic group, and neighborhood. Academic aptitudes and special talents should be cultivated wherever they are found, and a wise society will take all possible measures to insure this to the greatest possible extent. At the same time, those who are poor in the traditional academic aptitudes cannot be left by the wayside. Suitable means and goals must be found for making their years of schooling rewarding to them, if not in the usual academic sense, then in ways that can better their chances for socially useful and self-fulfilling roles as adults.

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