Book Reviews

Unknowns in the IQ Equation

Environment, Heredity, and Intelligence. Compiled from the *Harvard Educational Review*. Reprint Series No. 2. Harvard Educational Review, Cambridge, Mass., 1969. iv, 248 pp., illus. Paper, $4.95.

The IQ Argument. Race, Intelligence and Education. H. J. EYSENCK. Library Press, New York, 1971. iv, 156 pp., illus. $5.95.

I.Q. RICHARD HERRNSTEIN, in the *Atlantic*, Vol. 228, No. 3, Sept. 1971, pp. 44–64.

IQ scores have been repeatedly estimated to have a large heritable component in United States and Northern European white populations (*1*). Individual differences in IQ, many authors have concluded, arise far more from genetic than from environmental differences among people in these populations, at the present time, and under present environmental conditions. It has also been known for many years that white lower-class and black groups have lower IQ's, on the average, than white middle-class groups. Most behavioral scientists comfortably "explained" these group differences by appealing to obvious environmental differences between the groups in standards of living, educational opportunities, and the like. But recently an explosive controversy has developed over the heritability of between-group differences in IQ, the question at issue being: If individual differences within the white population as a whole can be attributed largely to heredity, is it not plausible that the average differences between social-class groups and between racial groups also reflect significant genetic differences? Can the former data be used to explain the latter?

To propose genetically based racial and social-class differences is anathema to most behavioral scientists, who fear any scientific confirmation of the pernicious racial and ethnic prejudices that abound in our society. But now that the issue has been openly raised, and has been projected into the public context of social and educational policies, a hard scientific look must be taken at what is known and at what inferences can be drawn from that knowledge.

The public controversy began when A. R. Jensen, in a long paper in the *Harvard Educational Review*, persuasively juxtaposed data on the heritability of IQ and the observed differences between groups. Jensen suggested that current large-scale educational attempts to raise the IQ's of lower-class children, white and black, were failing because of the high heritability of IQ. In a series of papers and rebuttals to criticism, in the same journal and elsewhere (*2*), Jensen put forth the hypothesis that social-class and racial differences in mean IQ were due largely to differences in the gene distributions of these populations. At least, he said, the genetic-differences hypothesis was no less likely, and probably more likely, than a simple environmental hypothesis to explain the mean difference of 15 IQ points between blacks and whites (*3*) and the even larger average IQ differences between professionals and manual laborers within the white population.

Jensen's articles have been directed primarily at an academic audience. Herrnstein's article in the *Atlantic* and Eysenck's book (first published in England) have brought the argument to the attention of the wider lay audience. Both Herrnstein and Eysenck agree with Jensen's genetic-differences hypothesis as it pertains to individual differences and to social-class groups, but Eysenck centers his attention on the genetic explanation of racial-group differences, which Herrnstein only touches on. Needless to say, many other scientists will take issue with them.

Eysenck's Racial Thesis

Eysenck has written a popular account of the race, social-class, and IQ controversy in a generally inflammatory book. The provocative title and the disturbing cover picture of a forlorn black boy are clearly designed to tempt the lay reader into a pseudo-battle between Truth and Ignorance. In this case Truth is genetic-environmental interactionism (*4*) and Ignorance is naive environmentalism. For the careful reader, the battle fades out inconclusively as Eysenck admits that scientific evidence to date does not permit a clear choice of the genetic-differences interpretation of black inferiority on intelligence tests. A quick reading of the book, however, is sure to leave the reader believing that scientific evidence today strongly supports the conclusion that U.S. blacks are genetically inferior to whites in IQ.

The basic theses of the book are as follows:

1) IQ is a highly heritable characteristic in the U.S. white population and probably equally heritable in the U.S. black population.

2) On the average, blacks score considerably lower than whites on IQ tests.

3) U.S. blacks are probably a nonrandom, lower-IQ, sample of native African populations.

4) The average IQ difference between blacks and whites probably represents important genetic differences between the races.

5) Drastic environmental changes will have to be made to improve the poor phenotypes that U.S. blacks now achieve.

The evidence and nonevidence that Eysenck cites to support his genetic hypothesis of racial differences make a curious assortment. Audrey Shuey's review (*5*) of hundreds of studies showing mean phenotypic differences between black and white IQ's leads Eysenck to conclude:

> All the evidence to date suggests the strong and indeed overwhelming importance of genetic factors in producing the great variety of intellectual differences which we observe in our culture, and much of the difference observed between certain racial groups. This evidence cannot be argued away by niggling and very minor criticisms of details which do not really throw doubts on the major points made in this book [p. 126].

To "explain" the genetic origins of these mean IQ differences he offers these suppositions:

> White slavers wanted dull beasts of burden, ready to work themselves to death in the plantations, and under those conditions intelligence would have been counter-selective. Thus there is every reason to expect that the particular sub-sample of the Negro race which is constituted of American Negroes is not an unselected sample of Negroes, but has been selected throughout history according to criteria which would put the highly intelligent at a disadvantage. The inevitable outcome of such selection would of course be a gene pool lacking some of the genes making for higher intelligence [p. 42].

Other ethnic minorities in the U.S. are also, in his view, genetically inferior, again because of the selective migration of lower IQ genotypes:

> It is known [*sic*] that many other groups came to the U.S.A. due to pressures which made them very poor samples of the original populations. Italians, Spaniards, and Portuguese, as well as Greeks, are examples where the less able, less intelligent were forced through circumstances to emigrate, and where their American progeny showed significantly lower IQ's than would have been shown by a random sample of the original population [p. 43].

Although Eysenck is careful to say that these are not established facts (because no IQ tests were given to the immigrants or nonimmigrants in question?), the tone of his writing leaves no doubt about his judgment. There is something in this book to insult almost everyone except WASP's and Jews.

Despite his conviction that U.S. blacks are genetically inferior in IQ to whites, Eysenck is optimistic about the potential effects of radical environmental changes on the present array of Negro IQ phenotypes. He points to the very large IQ gains produced by intensive one-to-one tutoring of black urban children with low-IQ mothers, contrasting large environmental changes and large IQ gains in intensive programs of this sort with insignificant environmental improvements and small IQ changes obtained by Headstart and related programs. He correctly observes that, whatever the heritability of IQ (or, it should be added, of any characteristic), large phenotypic changes may be produced by creating appropriate, radically different environments never before encountered by those genotypes. On this basis, Eysenck calls for further research to determine the requisites of such environments.

Since Eysenck comes to this relatively benign position regarding potential improvement in IQ's, why, one may ask, is he at such pains to "prove" the genetic inferiority of blacks? Surprisingly, he expects that new environments, such as that provided by intensive educational tutoring, will not affect the black-white IQ differential, because black children and white will probably profit equally from such treatment. Since many middle-class white children already have learning environments similar to that provided by tutors for the urban black children, we must suppose that Eysenck expects great IQ gains from relatively small changes in white, middle-class environments.

This book is an uncritical popularization of Jensen's ideas without the nuances and qualifiers that make much of Jensen's writing credible or at least responsible. Both authors rely on Shuey's review (*5*), but Eysenck's way of doing it is to devote some 25 pages to quotes and paraphrases of her chapter summaries. For readers to whom the original Jensen article is accessible, Eysenck's book is a poor substitute; although he defends Jensen and Shuey, he does neither a service.

It is a maddeningly inconsistent book filled with contradictory caution and incaution; with hypotheses stated both as hypotheses and as conclusions; with both accurate and inaccurate statements on matters of fact. For example, Eysenck thinks evoked potentials offer a better measure of "innate" intelligence than IQ tests. But on what basis? Recently F. B. Davis (*6*) has failed to find any relationship whatsoever between evoked potentials and either IQ scores or scholastic achievement, to which intelligence is supposed to be related. Another example is Eysenck's curious use of data to support a peculiar line of reasoning about the evolutionary inferiority of blacks: First, he reports that African and U.S. Negro babies have been shown to have precocious sensorimotor development by white norms (the difference, by several accounts, appears only in gross motor skills and even there is slight). Second, he notes that by three years of age U.S. white exceed U.S. black children in mean IQ scores. Finally he cites a (very slight) negative correlation, found in an early study, between sensorimotor intelligence in the first year of life and later IQ. From exaggerated statements of these various data, he concludes:

> These findings are important because of a very general view in biology according to which the more prolonged the infancy the greater in general are the cognitive or intellectual abilities of the species. This law appears to work even within a given species [p. 79].

Eysenck would apparently have us believe that Africans and their relatives in the U.S. are less highly evolved than Caucasians, whose longer infancy is related to later higher intelligence. I am aware of no evidence whatsoever to support a within-species relationship between longer infancy and higher adult capacities.

The book is carelessly put together, with no index; few references, and those not keyed to the text; and long, inadequately cited quotes that carry over several pages without clear beginnings and ends. Furthermore, considering the gravity of Eysenck's theses, the book has an occasional jocularity of tone that is offensive. A careful book on the genetic hypothesis, written for a lay audience, would have merited publication. This one, however, has been publicly disowned as irresponsible by the entire editorial staff of its London publisher, New Society. But never mind, the American publisher has used that and other condemnations to balance the accolades and make its advertisement (*7*) of the book more titillating.

Herrnstein's Social Thesis

Thanks to Jensen's provocative article, many academic psychologists who thought IQ tests belonged in the closet with the Rorschach inkblots have now explored the psychometric literature and found it to be a trove of scientific treasure. One of these is Richard Herrnstein, who from a Skinnerian background has become an admirer of intelligence tests—a considerable leap from shaping the behavior of pigeons and rats. In contrast to Eysenck's book, Herrnstein's popular account in the *Atlantic* of IQ testing and its values is generally responsible, if overly enthusiastic in parts.

Herrnstein unabashedly espouses IQ testing as "psychology's most telling accomplishment to date," despite the current controversy over the fairness of testing poor and minority-group children with IQ items devised by middle-class whites. His historical review of IQ test development, including tests of general intelligence and multiple abilities, is interesting and accurate. His account of the validity and usefulness of the tests centers on the fairly accurate prediction that can be made from IQ scores to academic and occupational achievement and income level. He clarifies the pattern of relationship between IQ and these criterion variables: High IQ is a necessary but not sufficient condition for high achievement, while low IQ virtually assures failure at high academic and occupational levels. About the usefulness of the tests, he concludes:

> An IQ test can be given in an hour or two to a child, and from this infinitesimally small sample of his output, deeply important predictions follow—about schoolwork, occupation, income, satisfaction with life, and even life expectancy. The predictions are not perfect, for other factors always enter in, but no other single factor matters as much in as many spheres of life [p. 53].

One must assume that Herrnstein's enthusiasm for intelligence tests rests on population statistics, not on predictions for a particular child, because many children studied longitudinally have been shown to change IQ scores by 20 points or more from childhood to adulthood. It is likely that extremes of giftedness and retardation can be sorted out relatively early by IQ tests, but what about the 95 percent of the population in between? Their IQ scores may vary from dull to bright normal for many years. Important variations in IQ can occur up to late adolescence (*8*). On a population basis Herrnstein is correct; the best early predictors of later achievement are ability measures taken from age five on. Predictions are based on correlations, however, which are not sensitive to absolute changes in value, only to rank orders. This is an important point to be discussed later.

After reviewing the evidence for average IQ differences by social class and race, Herrnstein poses the nature-nurture problem of "which is primary" in determining phenotypic differences in IQ. For racial groups, he explains, the origins of mean IQ differences are indeterminate at the present time because we have no information from heritability studies in the black population or from other, unspecified, lines of research which could favor primarily genetic or primarily environmental hypotheses. He is thoroughly convinced, however, that individual differences and social-class differences in IQ are highly heritable at the present time, and are destined, by environmental improvements, to become even more so:

> If we make the relevant environment much more uniform (by making it as good as we can for everyone), then an even larger proportion of the variation in IQ will be attributable to the genes. The average person would be smarter, but intelligence would run in families even more obviously and with less regression toward the mean than we see today [p. 58].

For Herrnstein, society is, and will be even more strongly, a meritocracy based largely on inherited differences in IQ. He presents a "syllogism" (p. 58) to make his message clear:

1. If differences in mental abilities are inherited, and
2. If success requires those abilities, and
3. If earnings and prestige depend on success,
4. Then social standing (which reflects earnings and prestige) will be based to some extent on inherited differences among people.

Five "corollaries" for the future predict that the heritability of IQ will rise; that social mobility will become more strongly related to inherited IQ differences; that most bright people will be gathered in the top of the social structure, with the IQ dregs at the bottom; that many at the bottom will not have the intelligence needed for new jobs; and that the meritocracy will be built not just on inherited intelligence but on all inherited traits affecting success, which will presumably become correlated characters. Thus from the successful realization of our most precious, egalitarian, political and social goals there will arise a much more rigidly stratified society, a "virtual caste system" based on inborn ability.

To ameliorate this effect, society may have to move toward the socialist dictum, "From each according to his abilities, to each according to his needs," but Herrnstein sees complete equality of earnings and prestige as impossible because high-grade intelligence is scarce and must be recruited into those critical jobs that require it, by the promise of high earnings and high prestige. Although garbage collecting is critical to the health of the society, almost anyone can do it; to waste high-IQ persons on such jobs is to misallocate scarce resources at society's peril.

Herrnstein points to an ironic contrast between the effects of caste and class systems. Castes, which established artificial hereditary limits on social mobility, guarantee the inequality of opportunity that preserves IQ heterogeneity at all levels of the system. Many bright people are arbitrarily kept down and many unintelligent people are artificially maintained at the top. When arbitrary bounds on mobility are removed, as in our class system, most of the bright rise to the top and most of the dull fall to the bottom of the social system, and IQ differences between top and bottom become increasingly hereditary. The greater the environmental equality, the greater the hereditary differences between levels in the social structure. The thesis of egalitarianism surely leads to its antithesis in a way that Karl Marx never anticipated.

Herrnstein proposes that our best strategy, in the face of increasing biological stratification, is publicly to recognize genetic human differences but to reallocate wealth to a considerable extent. The IQ have-nots need not be poor. Herrnstein does not delve into the psychological consequences of being publicly marked as genetically inferior.

Does the evidence support Herrnstein's view of hereditary social classes, now or in some future Utopia? Given his assumptions about the high heritability of IQ, the importance of IQ to social mobility, and the increasing environmental equality of rearing and opportunity, hereditary social classes are to some extent inevitable. But one can question the limits of genetic homogeneity in social-class groups and the evidence for his syllogism at present.

Is IQ as highly heritable throughout the social structure as Herrnstein assumes? Probably not. In a recent study of IQ heritability in various racial and social-class groups (*9*), I found much lower proportions of genetic variance that would account for aptitude differences among lower-class than among middle-class children, in both black and white groups. Social disadvantage in prenatal and postnatal development can substantially lower phenotypic IQ and reduce the genotype-phenotype correlation. Thus, average phenotypic IQ differences between the social classes may be considerably larger than the genotypic differences.

Are social classes largely based on hereditary IQ differences now? Probably not as much as Herrnstein believes. Since opportunities for social mobility act at the phenotypic level, there still may be considerable genetic diversity for IQ at the bottom of the social structure. In earlier days arbitrary social barriers maintained genetic variability throughout the social structure. At present, individuals with high phenotypic IQ's are often upwardly mobile; but inherited wealth acts to maintain genetic diversity at the top, and nongenetic biological and social barriers to phenotypic development act to maintain a considerable genetic diversity of intelligence in the lower classes.

As P. E. Vernon has pointed out (*10*), we are inclined to forget that the majority of gifted children in recent generations have come from working-class, not middle-class, families. A larger percentage of middle-class children are gifted, but the working and lower classes produce gifted children in larger numbers. How many more disadvantaged children would have been bright if they had had middle-class gestation and rearing conditions?

I am inclined to think that intergenerational class mobility will always be with us, for three reasons. First, since normal IQ is a polygenic characteristic, various recombinations of parental genotypes will always produce more varia-

ble genotypes in the offspring than in the parents of all social-class groups, especially the extremes. Even if both parents, instead of primarily the male, achieved social-class status based on their IQ's, recombinations of their genes would always produce a range of offspring, who would be upwardly or downwardly mobile relative to their families of origin.

Second, since, as Herrnstein acknowledges, factors other than IQ—motivational, personality, and undetermined—also contribute to success or the lack of it, high IQ's will always be found among lower-class adults, in combination with schizophrenia, alcoholism, drug addiction, psychopathy, and other limiting factors. When recombined in offspring, high IQ can readily segregate with facilitating motivational and personality characteristics, thereby leading to upward mobility for many offspring. Similarly, middle-class parents will always produce some offspring with debilitating personal characteristics which lead to downward mobility.

Third, for all children to develop phenotypes that represent their best genotypic outcome (in current environments) would require enormous changes in the present social system. To improve and equalize all rearing environments would involve such massive intervention as to make Herrnstein's view of the future more problematic than he seems to believe.

Race as Caste

Races are castes between which there is very little mobility. Unlike the social-class system, where mobility based on IQ is sanctioned, the racial caste system, like the hereditary aristocracy of medieval Europe and the caste system of India, preserves within each group its full range of genetic diversity of intelligence. The Indian caste system was, according to Dobzhansky (*11*), a colossal genetic failure—or success, according to egalitarian values. After the abolition of castes at independence, Brahmins and untouchables were found to be equally educable despite—or because of—their many generations of segregated reproduction.

While we may tentatively conclude that there are some genetic IQ differences between social-class groups, we can make only wild speculations about racial groups. Average phenotypic IQ differences between races are not evidence for genetic differences (any more than they are evidence for environmental differences). Even if the heritabilities of IQ are extremely high in all races, there is still no warrant for equating within-group and between-group heritabilities (*12*). There are examples in agricultural experiments of within-group differences that are highly heritable but between-group differences that are entirely environmental. Draw two random samples of seeds from the same genetically heterogeneous population. Plant one sample in uniformly good conditions, the other in uniformly poor conditions. The average height difference between the populations of plants will be entirely environmental, although the individual differences in height within each sample will be entirely genetic. With known genotypes for seeds and known environments, genetic and environmental variances between groups can be studied. But racial groups are not random samples from the same population, nor are members reared in uniform conditions within each race. Racial groups are of unknown genetic equivalence for polygenic characteristics like IQ, and the differences in environments within and between the races may have as yet unquantified effects.

There is little to be gained from approaching the nature-nurture problem of race differences in IQ directly (*13*). Direct comparisons of estimated within-group heritabilities and the calculation of between-group heritabilities require assumptions that few investigators are willing to make, such as that all environmental differences are quantifiable, that differences in the environments of blacks and whites can be assumed to affect IQ in the same way in the two groups, and that differences in environments between groups can be "statistically controlled." A direct assault on race differences in IQ is vulnerable to many criticisms.

Indirect approaches may be less vulnerable. These include predictions of parent-child regression effects and admixture studies. 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. This hypothesis assumes that assortative mating for IQ is equal in the two races, which could be empirically determined but has not been studied as yet. Interpretable results from a parent-child regression study would also depend upon careful attention to intergenerational environmental changes, which could be greater in one race than the other.

Studies based on correlations between degree of white admixture and IQ scores *within* the black group would avoid many of the pitfalls of between-group comparisons. If serological genotypes can be used to identify persons with more and less white admixture, and if estimates of admixture based on blood groups are relatively independent of visible characteristics like skin color, then any positive correlation between degree of admixture and IQ would suggest genetic racial differences in IQ. Since blood groups have not been used directly as the basis of racial discrimination, positive findings would be relatively immune from environmentalist criticisms. The trick is to estimate individual admixture reliably. Several loci which have fairly different distributions of alleles in contemporary African and white populations have been proposed (*14*). No one has yet attempted a study of this sort.

h^2 and Phenotype

Suppose that the heritabilities of IQ differences within all racial and social-class groups were .80, as Jensen estimates, and suppose that the children in all groups were reared under an equal range of conditions. Now, suppose that racial and social-class differences in mean IQ still remained. We would probably infer some degree of genetic difference between the groups. So what? The question now turns from a strictly scientific one to one of science and social policy.

As Eysenck, Jensen, and others (*14*) have noted, eugenic and euthenic strategies are both possible interventions to reduce the number of low-IQ individuals in all populations. Eugenic policies could be advanced to encourage or require reproductive abstinence by people who fall below a certain level of intelligence. The Reeds (*15*) have determined that one-fifth of the mental retardation among whites of the next generation could be prevented

if no mentally retarded persons of this generation reproduced. There is no question that a eugenic program applied at the phenotypic level of parents' IQ would substantially reduce the number of low-IQ children in the future white population. I am aware of no studies in the black population to support a similar program, but some proportion of future retardation could surely be eliminated. It would be extremely important, however, to sort out genetic and environmental sources of low IQ both in racial and in social-class groups before advancing a eugenic program. The request or demand that some persons refrain from any reproduction should be a last resort, based on sure knowledge that their retardation is caused primarily by genetic factors and is not easily remedied by environmental intervention. Studies of the IQ levels of adopted children with mentally retarded natural parents would be most instructive, since some of the retardation observed among children of retarded parents may stem from the rearing environments provided by the parents.

In a pioneering study of adopted children and their adoptive and natural parents, Skodak (*16*) reported greater *correlations* of children's IQ's with their natural than with their adoptive parents' IQ's. This statement has been often misunderstood to mean that the children's *levels* of intelligence more closely resembled their natural parents', which is completely false. Although the rank order of the children's IQ's resembled that of their mothers' IQ's, the children's IQ's were higher, being distributed, like those of the adoptive parents, around a mean above 100, whereas their natural mothers' IQ's averaged only 85. The children, in fact, averaged 21 IQ points higher than their natural mothers. If the (unstudied) natural fathers' IQ's averaged around the population mean of 100, the mean of the children's would be expected to be 94, or 12 points lower than the mean obtained. The unexpected boost in IQ was presumably due to the better social environments provided by the adoptive families. Does this mean that phenotypic IQ can be substantially changed?

Even under existing conditions of child rearing, phenotypes of children reared by low-IQ parents could be markedly changed by giving them the same rearing environment as the top IQ group provide for their children. According to DeFries (*17*), if children whose parents average 20 IQ points below the population mean were reared in environments such as usually are provided only by parents in the top .01 percent of the population, these same children would average 5 points *above* the population mean instead of 15 points below, as they do when reared by their own families.

Euthenic policies depend upon the demonstration that different rearing conditions can change phenotypic IQ sufficiently to enable most people in a social class or racial group to function in future society. I think there is great promise in this line of research and practice, although its efficacy will depend ultimately on the cost and feasibility of implementing radical intervention programs. Regardless of the present heritability of IQ in any population, phenotypes can be changed by the introduction of new and different environments. (One merit of Eysenck's book is the attention he gives to this point.) Furthermore, it is impossible to predict phenotypic outcomes under very different conditions. For example, in the Milwaukee Project (*18*), in which the subjects are ghetto children whose mothers' IQ's are less than 70, intervention began soon after the children were born. Over a four-year period Heber has intensively tutored the children for several hours every day and has produced an enormous IQ difference between the experimental group (mean IQ 127) and a control group (mean IQ 90). If the tutored children continue to advance in environments which are radically different from their homes with retarded mothers, we shall have some measure of the present phenotypic range of reaction (*19*) of children whose average IQ's might have been in the 80 to 90 range. These data support Crow's comment on h^2 in his contribution to the *Harvard Educational Review* discussion (p. 158):

> It does not directly tell us how much improvement in IQ to expect from a given change in the environment. In particular, it offers no guidance as to the consequences of a new kind of environmental influence. For example, conventional heritability measures for height show a value of nearly 1. Yet, because of unidentified environmental influences, the mean height in the United States and in Japan has risen by a spectacular amount. Another kind of illustration is provided by the discovery of a cure for a hereditary disease. In such cases, any information on prior heritability may become irrelevant. Furthermore, heritability predictions are less dependable at the tails of the distribution.

To illustrate the phenotypic changes that can be produced by radically different environments for children with clear genetic anomalies, Rynders (*20*) has provided daily intensive tutoring for Down's syndrome infants. At the age of two, these children have average IQ's of 85 while control-group children, who are enrolled in a variety of other programs, average 68. Untreated children have even lower average IQ scores.

The efficacy of intervention programs for children whose expected IQ's are too low to permit full participation in society depends on their long-term effects on intelligence. Early childhood programs may be necessary but insufficient to produce functioning adults. There are critical research questions yet to be answered about euthenic programs, including what kinds, how much, how long, how soon, and toward what goals?

Does h^2 Matter?

There is growing disillusionment with the concept of heritability, as it is understood and misunderstood. Some who understand it very well would like to eliminate h^2 from human studies for at least two reasons. First, the usefulness of h^2 estimates in animal and plant genetics pertains to decisions about the efficacy of selective breeding to produce more desirable phenotypes. Selective breeding does not apply to the human case, at least so far. Second, if important phenotypic changes can be produced by radically different environments, then, it is asked, who cares about the heritability of IQ? Morton (*21*) has expressed these sentiments well:

> Considerable popular interest attaches to such questions as "is one class or ethnic group innately superior to another on a particular test?" The reasons are entirely emotional, since such a difference, if established, would serve as no better guide to provision of educational or other facilities than an unpretentious assessment of phenotypic differences.

I disagree. The simple assessment of phenotypic performance does not suggest any particular intervention strategy. Heritability estimates can have merit as indicators of the effects to be expected from various types of intervention programs. If, for example, IQ tests, which predict well to achievements in the larger society, show low heritabilities in a population, then it is probable that simply providing better environments which now exist will im-

prove average performance in that population. If h^2 is high but environments sampled in that population are largely unfavorable, then (again) simple environmental improvement will probably change the mean phenotypic level. If h^2 is high and the environments sampled are largely favorable, then novel environmental manipulations are probably required to change phenotypes, and eugenic programs may be advocated.

The most common misunderstanding of the concept "heritability" relates to the myth of fixed intelligence: if h^2 is high, this reasoning goes, then intelligence is genetically fixed and unchangeable at the phenotypic level. This misconception ignores the fact that h^2 is a population statistic, bound to a given set of environmental conditions at a given point in time. Neither intelligence nor h^2 estimates are fixed.

It is absurd to deny that the frequencies of genes for behavior may vary between populations. For individual differences within populations, and for social-class differences, a genetic hypothesis is almost a necessity to explain some of the variance in IQ, especially among adults in contemporary white populations living in average or better environments. But what Jensen, Shuey, and Eysenck (and others) propose is that genetic racial differences are necessary to account for the current phenotypic differences in mean IQ between populations. That may be so, but it would be extremely difficult, given current methodological limitations, to gather evidence that would dislodge an environmental hypothesis to account for the same data. And to assert, despite the absence of evidence, and in the present social climate, that a particular race is genetically disfavored in intelligence is to scream "FIRE! . . . I think" in a crowded theater. Given that so little is known, further scientific study seems far more justifiable than public speculations.

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References and Notes

1. For a review of studies, see L. Erlenmeyer-Kimling and L. F. Jarvik, *Science* **142**, 1477 (1963). Heritability is the ratio of genetic variance to total phenotypic variance. For human studies, heritability is used in its broad sense of total genetic variance/total phenotypic variance.
2. The *Harvard Educational Review* compilation includes Jensen's paper, "How much can we boost IQ and scholastic achievement?," comments on it by J. S. Kagan, J. McV. Hunt, J. F. Crow, C. Bereiter, D. Elkind, L. J. Cronbach, and W. F. Brazziel, and a rejoinder by Jensen. See also A. R. Jensen, in J. Hellmuth, *Disadvantaged Child*, vol. 3 (Special Child Publ., Seattle, Wash., 1970).
3. P. L. Nichols, thesis, University of Minnesota (1970). Nichols reports that in two large samples of black and white children, seven-year WISC IQ scores showed the same means and distributions for the two racial groups, once social-class variables were equated. These results are unlike those of several other studies, which found that matching socioeconomic status did not create equal means in the two racial groups [A. Shuey (*5*); A. B. Wilson, *Racial Isolation in the Public Schools*, vol. 2 (Government Printing Office, Washington, D.C., 1967)]. In Nichols's samples, prenatal and postnatal medical care was equally available to blacks and whites, which may have contributed to the relatively high IQ scores of the blacks in these samples.
4. By interaction, Eysenck means simply $P = G + E$, or "heredity and environment acting together to produce the observed phenotype" (p. 111). He does not mean what most geneticists and behavior geneticists mean by interaction; that is, the *differential* phenotypic effects produced by various combinations of genotypes and environments, as in the interaction term of analysis-of-variance statistics. Few thinking people are not interactionists in Eysenck's sense of the term, because that's the only way to get the organism and the environment into the same equation to account for variance in any phenotypic trait. How much of the phenotypic variance is accounted for by each of the terms in the equation is the real issue.
5. A. Shuey, *The Testing of Negro Intelligence* (Social Science Press, New York, 1966), pp. 499–519.
6. F. B. Davis, *The Measurement of Mental Capacity through Evoked-Potential Recordings* (Educational Records Bureau, Greenwich, Conn., 1971). "As it turned out, no evidence was found that the latency periods obtained . . . displayed serviceable utility for predicting school performance or level of mental ability among pupils in preschool through grade 8" (p. v).
7. *New York Times*, 8 Oct. 1971, p. 41.
8. J. Kagan and H. A. Moss, *Birth to Maturity* (Wiley, New York, 1962).
9. S. Scarr-Salapatek, *Science*, in press.
10. P. E. Vernon, *Intelligence and Cultural Environment* (Methuen, London, 1969).
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