an answer to this question. The answer is unambiguous and is generally agreed upon by all scientists who have considered all the evidence. This evidence strongly supports the conclusion that genetic factors are much more important than environmental influences in accounting for individual differences in I.Q. How much more important? The evidence indicates that genetic factors account for at least twice as much of the variation in I.Q. as environmental factors. This conclusion has one main limitation. Since all of the major studies in this field were conducted with samples of Caucasian European and North American populations, we cannot confidently generalize their conclusions to other populations, especially those with very dissimilar environments.

What are the kinds of evidence that lead to the conclusion that genetic differences outweigh environmental differences in accounting for individual differences in I.Q.? Most of this evidence, as it is found in the scientific literature, depends upon quite technical methods of analysis developed in a specialty known as quantitative genetics or population genetics. Some of these methods were devised originally to analyze the roles of heredity and environment in agriculture and animal breeding.

Experiments in Animal Breeding

Experiments in which we explicitly try to breed for some specific trait give us the most certain evidence that variation in the trait has a genetic component. Psychologists have bred rats for speed of learning mazes, which is a good indicator of rat intelligence. By always mating the fast-learning males with fast-learning females, and mating slow-learning males with slow-learning females, it is possible, within 6 to 10 generations, to produce two quite distinct strains of rats in respect to maze-learning ability. The slowest-learning rat of the “bright” strain will learn mazes faster than the fastest rat of the “dull” strain. The two strains will differ markedly in the number of trials they need to learn how to run through a maze efficiently, avoiding the blind alleys. These experiments definitely prove that not only physical characteristics but some behavioral traits as well are largely inherited through the parental genes. Thus we should not be surprised to find in humans that differences in some behavioral characteristics, including intelligence, are a product of genetic inheritance.

Identical Twins Reared Apart

One of the most important lines of evidence for the inheritance of intelligence in humans comes from studies of identical twins who were separated shortly after birth and reared in different homes. Identical twins originate from a single fertilized ovum which splits in the course of early development to form two individuals. Each member of the pair of twins therefore has exactly the same complement of genes. Consequently, any difference between the two twins must be due entirely to non-genetic or environmental differences.

 Twins separated shortly after birth are often reared in families that differ markedly in social class, and the range of environmental differences observed in their foster homes is fairly typical of the environmental variations seen in the general population.

 Four major studies of identical twins reared apart, conducted in England, Denmark, and the United States, and totaling 122 pairs of twins, are in remarkably close agreement in showing that twins reared in different homes are still much more sequence, knowing a person’s intelligence-test score or scholastic-aptitude-test score has become a matter of great importance in the United States, not only to admissions officers who use it to pick people for college but also to businesses and civil-service commissions who use it to decide who is “bright enough” to be a policeman, a social worker or a fireman.

 Testing has therefore become big business. The Educational Testing Service which gives the Scholastic Aptitude Test used by most of the better-known colleges and universities in the United States employs around two thousand people and has a large plant spread over hundreds of acres in Princeton, New Jersey. Thousands of young people pay to take its tests annually to see if they are qualified to get into the college of their choice. The testing technology has been so sold to the American public that only in a few of the more “backward” parts of the society is it not used in the schools or businesses or civil service. And of course it is spreading fast to the rest of the world, which is beginning to discover the utility of tests for picking those who will do well in school.

 To be sure, the testers themselves loudly insist that there are other important human qualities besides the ability to take scholastic aptitude tests, but as Wing and Wallach (1971) have shown, admissions officers may believe they take these other qualities into account but in fact their selection decisions can be almost perfectly predicted by aptitude-test scores alone. The desire to select more “intelligent” people for schooling or for almost any occupation proves overpowering. It quickly reduces other qualifications to insignificance.

 While the intelligence-testing movement in the United States has been moving on from one triumph to the next, some questions have been raised about its theoretical underpinnings, both by scholars and by policy makers who wonder if its growing power over people’s lives is justified. One difficulty with tests has long been known but little commented on perhaps because its seriousness has not been fully appreciated. It is very simply that if academic achievement tests are taken seriously as measures of real competence, then the quality of education does not seem to contribute to improving competence. Back in the 1930’s in the United States, a number of private schools tried to improve the quality of their education as part of what was then known as the “progressive education movement.” Standardized scholastic achievement tests were used to evaluate the effects of this supposedly improved education as compared with more traditional teaching.

 By and large no effects of the supposedly higher-quality education could be discovered in the test scores. The educators felt they were doing a better job but the test scores did not indicate that they were. The same finding has turned up again and again since that time. Certain colleges in the United States are widely acknowledged to be better than other colleges—in the sense that they have better faculties, more books in the library, higher endowments, better laboratory facilities, and so forth. Yet repeated studies as summarized by Jacob (1957) have failed to show any test-score differences attributable to the better education supposedly obtained in the elite colleges. If the graduates of those colleges perform better on achievement tests, it is because they scored higher on them at entrance to college, not because they received a better education subsequently.
Most recently in a very important social document on equality of educational opportunity, Coleman (1966) again showed that the quality of education (here in secondary school) seemed to have very little effect on the academic achievement test scores of children. In other words the children who went to poor schools with poorly trained teachers, dilapidated buildings, and crowded classrooms did no worse on the tests than children who went to excellent, well-equipped schools with low teacher-pupil ratios, once one had corrected for the initial differences in intelligence and social background of the pupils attending the two types of schools. In other words what the test results seem to have shown over and over again is that quality of education makes no difference in improving competence.

What does make a difference are the attributes of the people getting the education—their intelligence, their social characteristics and so forth. Why then should citizens spend so much money trying to improve education? Why should educational psychologists be trying to find better ways of educating pupils? Why is money wasted on conferences to try to find ways of improving education—if in fact the data clearly show that educational variations have very little effect on academic achievement, which in turn is considered the main measure of competence for life's tasks?

One reason is that we keep suspecting that the educators may be right in continuing to think that the quality of education does make a difference. It may be the psychological testers who are wrong: their tests may simply not be adequate measures of the competence which better education produces. In fact there may even be a built-in theoretical reason why most existing tests are inadequate measures of variations in the quality of education. Most testers have worked hard to create tests which are reliable—that is, which will give the same score to the same individual when tested again. An instrument which is designed to be very reliable may not be very sensitive to changes that have actually taken place in the person through education.

But this theoretical problem has never shaken the self-confidence of the testing movement. It has continued to roll on like a juggernaut overwhelming all such doubts.

When many psychologists began to examine really seriously for the first time the assumptions on which the intelligence testing movement had been built, it took them no time at all to discover that many intelligence tests had a built-in middle-class bias. The vocabulary used in the tests was so-called "standard English," not the dialect spoken in many ghetto communities. So the children from these communities often did not even understand the instructions for the tests, let alone the questions they were supposed to identify which were not part of the vocabulary in common use in their community. Correct answers to questions also often assume a standard middle-class way of life. For example a child is asked on an intelligence test, "What would you do if you were sent to the store by your mother to buy something and you found the store didn't have it?" The "intelligent" or correct answer is supposed to be that you would go to another store to see if they had it. However this is certainly not an intelligent answer for a ghetto child who is under strict orders from his mother to come straight home from the store because she is afraid he might be robbed or beaten if he strayed.

Comments on Individual and Group Differences in I.Q.

SANDRA SCARR-SALAPATEK

Thanks to Jensen's provocative article, many academic psychologists who thought I.Q. tests belonged in the closet with the Rorschach inksblots 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 [B.F. Skinner, Professor of Psychology, Harvard University] has become an admirer of intelligence tests—a considerable leap from shaping the behavior of pigeons and rats. Herrnstein's popular account in the Atlantic of I.Q. testing and its values is generally responsible, if overly enthusiastic in parts. Herrnstein unabashedly espouses I.Q. testing as "psychology's most telling accomplishment to date," despite the current controversy over the fairness of testing poor and minority-group children with I.Q. items devised by middle-class whites. His historical review of I.Q. 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 I.Q. scores about academic and occupational achievement and income level. He clarifies the pattern of relationship between I.Q. and these criterion variables: High I.Q. is a necessary but not sufficient condition for high achievement, while low I.Q. virtually assures failure at high academic and occupational levels. 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 I.Q. scores by twenty points or more from childhood to adulthood. It is likely that extremes of giftedness and retardation can be sorted out relatively early by I.Q. tests but what about the 95 percent of the population in between? Their I.Q. scores may vary from dull to bright normal for many years. Important variations in I.Q., can occur up to late adolescence. 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 I.Q. differences by social class and race, Herrnstein poses the nature-nurture problem of "which is primary?" in determining phenotypic differences in I.Q. For racial groups, he explains, the origins of mean I.Q. 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 I.Q. are highly heritable at the present time and are destined, by environmental improvements, to become even more so.

For Herrnstein, society is, and will be even more strongly, a meritocracy based largely on inherited differences in I.Q.

Five "corollaries" for the future predict that the heritability of I.Q. will rise; that social mobility will become more strongly related to inherited I.Q. differences; that most bright people will be gathered in the top of the social structure, with the I.Q. 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-I.Q. persons on such jobs is to misallocate scarce resources at society's peril.

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the educational implications of the wide range of apparent differences in educability in our population.

There is fundamentally, in my opinion, a 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 and 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.

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, if not in the usual academic sense, then in ways that can better their chances for socially useful and self-respecting lives and in so doing further the egalitarian ideology has prevented us from realizing. We have invested so much in public education in the United States to secure for all children, ranging over a wider spectrum of educational opportunity than is available to any one, the educational systems which will enable them to be professionals rather than laborers. The advantages which enabled them to be professionals rather than laborers. The advantage that conferred how intelligent the person was, in every school, the higher score on the test in fact meant that the person was better on the test and did better on the test.

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 school 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 environmentalism has made us all but completely stilled 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 new ways of diversifying schools to make them rewarding to everyone while not attempting to equalize everyone’s performance in a common curriculum.

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 of different capacities 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 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.

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In this sense the test becomes an instrument for those in power to screen out those who do not know the right words and who are therefore "unqualified" to be lawyers in the minds of those who control such things. Now such a selection procedure may be justifiable in one way or another but it does serve to make clear that the central issue is who is in power and controlling resources, not who is genetically inferior in intelligence.

American psychologists have long accepted without question Professor Terman's conclusion (1947) that his gifted children (those with higher intelligence test scores) grew up to be more successful occupationally, maritally, and socially than those whose average intelligence and that they showed fewer "morally deviant" forms of psychopathology such as alcoholism or homosexuality. Yet the power analysis just carried out suggests that neither Professor Terman nor anyone else has as yet brought forward conclusive evidence that it is giftedness per se as he measured it that is responsible for these happier life outcomes. For his gifted children were also drawn very disproportionately from the ranks of the educated, the wealthy, and the powerful. This means that they had not only a better chance to acquire the characteristics measured in the test but also to be happier (since they had more money) and also to have access to higher education and better social standing. Maybe test scores measuring "giftedness" are simply another symptom of their generally more favorable social status.

"Did you ever see a woman who fitted so well into surroundings like this—who seems herself to be designed for contemporary living?" said Otto. "A rare thing, believe me. I've had many famous beauties around here, but Falloleen is the only one who doesn't look like a piece of 1920-vintage overstuffed furniture in this house."

"How long have you been married?" I said.

"The party upstairs is in celebration of one month of blissful marriage," said Otto; "of a honeymoon that will never end."

"How nice," I said. "And now, about your financial picture—"

"You could go out to supper with me tonight," said Otto, "and then come back and work undisturbed here in the studio. I'm sorry we have to go out, but it's the cook's day off."

"That's swell," I said, "but, in the meantime, I'd like to go over your bills to see exactly how deep in you are, and also to figure out what allowance you could get by on at a bare minimum."

"You could go out to supper with us tonight," said Otto, "and then come back and work undisturbed here in the studio. I'm sorry we have to go out, but it's the cook's day off."

"That would suit me fine," I said.

"Then I'll have you around to answer questions. There ought to be plenty of those. For instance, how much is in the basket?"

"Oh, you know about the basket?" he said. "I'm afraid we can't use that. That's special."

"In what way?" I said.

"I need it—not for me, for Falloleen. "Can't I keep that much, and send you all the royalty checks that come in from now on? It isn't right to make Falloleen suffer because of my mistakes. Don't force