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, one strain being fast-learning and the other slow-learning. 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 alley tests. These experiments definitively 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 differences in some behavioral characteristics, including intelligence, that 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

Do I.Q. Tests Measure Intelligence?

DAVID C. McCLELLAND

Psychology has one great practical success to its credit in the twentieth century—namely the intelligence testing movement. Many tests have been devised which predict success in school with remarkable regularity. Literally tens of thousands of validity coefficients have been calculated, demonstrating that those who score higher on aptitude or intelligence tests usually do better in their school work. Selecting, at random, a finding which is quite typical for the United States, I recently observed in a longitudinal study to be reported by Costa (1972) that Kuhlman-Anderson I.Q. scores obtained in the sixth grade correlated 0.59 with twelfth-grade rank in class. In other words knowing how a child scores on an intelligence test when he is eleven or twelve years old enables you to predict fairly accurately how well he will be doing in school some six or seven years later. Rank in class at graduation from secondary school in turn predicts whether he can go on to the university and how good a university he will get into. As a consequence, 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.

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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 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 [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. drop 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 in schools in favor of 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 solving educational problems rather than at coming to grips with them.

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 someone is taught to read, the better. Forced early learning, prior to some satisfactory level of readiness (which will differ markedly from one child to another), could cause many children to have learning disabilities which later on practically defy remediation. The more or less uniform lockstep 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 of all background or geographic origin, and later performance in school be

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 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-supporting lives and service to society.

California Institute of Technology Engineering and Science magazine, Pasadena, California, April, 1970.

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too far from familiar territory. Yet if he says he would go home he is judged by the testers to be less intelligent. It is also easy to see from these examples why there is a correlation between test performance and later performance in school because the teacher, as a representative of standard middle-class culture, will expect the same language and types of behavior as the person who made up the so-called intelligence test. The teacher will either not understand the dialect that is used in class or will give the child a lower mark for using "bad" language and the ghetto child will before long go through life stigmatized as being less intelligent and a poor student.

Looking at the problem this way forced psychologists to consider seriously another possible explanation for many of the existing correlations between intelligence test scores doing well in school and holding down higher-status jobs later in life. Those who control not only economic and social opportunities but also what language and values are the standards by which others will be judged, may in fact be able to use test scores to maintain their power. All one needs to assume is that more powerful and wealthy persons are much better placed to help their children get higher-status jobs: they know the right people; they can send their children to the right schools; they can use the influence they have for their children directly. So it turns out that people in higher-status jobs score higher on so-called intelligence tests.

But where is the direct evidence that the higher score on the test in fact indicated that the person was better able to do the higher-status job? As every psychologist knows, correlation does not mean causation. It doesn't follow that because professionals score higher than laborers on certain tests that it is the ability to perform those particular tests which enabled them to be professionals rather than laborers. The reason why people have assumed that causation was involved is that the test scores were supposed to indicate how intelligent the person was, and it seems reasonable to assume that being a professional requires more of something called intelligence than being a laborer does. However it is by no means as self-evident as it once was that these test scores measure the kind of intelligence implied by the logic of this

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argument. They may simply indicate that the person has the credentials that the power elite insists that he must have in order to hold a higher-status job. This is the type of test performance and job performance may well be extrinsic rather than intrinsic. That is, being able to use the right words may have nothing to do intrinsically with whether a person is a cleverer lawyer, but those in power in a society simply decree that a person cannot be a lawyer unless he uses the correct vocabulary.

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 of 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 occupations and better social standing. Maybe test scores measuring "giftedness" are simply another symptom of their generally more favorable social status.

"...And, of course, you just don't even go near a potato!"

You're not dressed for 1954," I said humbly, "but I'm dressed for selling securities."

"You are being suffocated by tradition," said Otto. "Why don't you say, 'I am going to build a life for myself, for my time, and make it a work of art?' Your life isn't a work of art—it's a third-hand Victorian whatnot shelf, complete with someone else's collection of seashells and hand-carved elephants."

"And you must be the wizard of high finance. We can go into my studio, where we'll have more privacy, and then you can join us in a drink."

His studio was inside the brick cylinder, and he led me through a door and down another spiral ramp into it. There were no windows. All the light was artificial.

"Guess this is the most modern house I've ever been in," I said.

"Modern?" said Otto. "It's twenty years behind the times, but it's the best my imagination can do. Everything else is at least a hundred years behind the times, and that is why we have all the unrest, this running to psychiatrists, broken homes, wars. We haven't learned to design our living for our own times. Our lives clash with our times. Look at your clothes! Shades of 1910."

"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."

"Yes, I admit it," said Otto. "The connection between credentials that the person has the argument. They may simply indicate less he uses the correct vocabulary.

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