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Intelligence

The inheritance of intelligence, and the policy implications that this may or may not have, is currently the most controversial and divisive issue at the interface between science and society. This is in part because of *The Bell Curve*,[37] which has given respectability to the notion that it is right and proper to discriminate against the disadvantaged. While the book is badly flawed, the authors should perhaps be applauded for catalyzing many scientists more qualified than themselves to address publicly the inheritance of intelligence. But the book should also be seen for what it is: a political agenda masquerading as science, a mean-spirited diatribe against the poor and disenfranchised, and a pseudointellectual legitimization of racism. Racism is revealed, not in recognizing that racial differences exist, but in judging that some racial traits are better than others, and in believing that all racial traits are genetically fixed and immutable.

The reason why the inheritance of intelligence is such a volatile issue is clear. But the reason why so little has been said about intelligence by reputable scientists in the past decade is not clear. Scientists are often reluctant to leave the cloistered environment of the laboratory or the lecture hall to confront the issues of the day. This reluctance may arise because scientists are not interested, or because they feel unqualified, or because they are shy, or simply because they think the public is not ready for science. Most scientists are accustomed to seeing stories about science reported in the lay press that are so badly mangled or oversimplified or out-of-context that they are no longer true. Yet,

by their reluctance to confront the issues of the day, scientists have allowed themselves to be exploited by the writers of *The Bell Curve*.

It has also been intellectually fashionable, for many years now, to emphasize the importance of the environment in determining human behavior. In fact, many scientists have mistakenly regarded humans as a *tabula rasa*, a blank slate on which experience writes. In this view, the genetics of human behavior is of no importance, since all behaviors are learned. This viewpoint first gained respectability after World War II, when scientists became aware of the unspeakable horrors of the eugenic program practiced by the Nazis. The environmentalist viewpoint was firmly entrenched during the 1960s, when it seemed that all things were possible for Americans; we could triumph over the Nazis and eventually the Russians, we could land on the moon, and we could certainly triumph over our genes. Psychology was enamored with the idea that good behavior could be programmed into the individual, and psychiatry was fixated on individual experience as the key to all mental illness. In this context, it is no surprise that the genetics of behavior was downplayed.

The first real crack in the armor of environmentalism was sociobiology, a set of ideas that were introduced to the public in the mid-1970s. Sociobiology claimed that animal behavior is strongly hereditary, and that we can gain insight into human society by studying animal societies. These ideas were a rude slap to many, because of the long-standing and very comfortable belief that we, as humans, can rise above our genes. One of the most vigorous defenses of environmentalism can be found in the book *Not in Our Genes*, which was cowritten by Richard Lewontin, a very prominent geneticist. This book is a well-researched and well-presented attempt to refute the role of genetics in human behavior, yet it is written by the same geneticist who was quoted as saying, "Nothing we can know about the genetics of human behavior can have any implications for human society." This statement is no longer compelling, and

it clearly illustrates the difficulty that many scientists had in moving beyond the environmentalist doctrine.

What Is Intelligence?

Everyone has an intuitive feel for which of their friends is most intelligent, but a concise and unambiguous definition of the quality is very difficult to achieve. The philosopher Homer believed that intelligence is a gift of grace that not all men possess. Many centuries later, in 1923, with far less insight than Homer could muster, E. G. Boring claimed that "intelligence is what the intelligence test measures." This circularity of definition represents very nearly the state of the art today; we cannot define the quality well, yet we claim to recognize it in others, and to measure it accurately with some fairly simple tests. Nevertheless, whatever trait is actually measured by an intelligence test does tend to be rather constant over one's lifetime, and does have some ability to predict success in school and in the workplace.

What seems clear is that intelligence is not a trait like height, with a single dimension that is easy to measure.[38] Virtually all scientists who study intelligence agree that intelligence involves the exchange of information between working memory and long-term memory. In computer terms, this is analogous to exchanges between random-access memory (RAM) and the hard disk. In simpler terms, this can be thought of as exchange between your desk top and your desk drawers; the information you need right away is kept on your desk top, while the information that is perhaps less pressing is kept in the drawer. All of this information is, of course, updated frequently on the basis of new stimuli in the sensory environment; this is what makes it possible to learn from experience. Thinking is thus the exchange of information between sensory input, working memory, and long-term memory. Modern intelligence tests use several different subtests to measure these exchanges, including

word knowledge, short-term memory, deductive reasoning, and the ability to perceive and manipulate patterns implicit in a geometric design. The intelligence quotient (IQ) with which everyone is familiar is actually a weighted composite of the various subtests on an intelligence test. This weighted composite score is normalized to the age of the person tested, so that IQ is actually a ratio of mental age to chronological age (multiplied by 100).

The subtests on an intelligence test are interrelated in a subtle way; even though each was originally developed to measure a different cognitive function, people who do well on one subtest tend to do well on other subtests. People who are gifted in terms of verbal ability tend also to be above average in other mental abilities, such as the ability to manipulate visual patterns or the ability to retrieve things from short-term memory. This suggests that a relatively small number of general abilities can determine performance on what are ostensibly different subtests. Because IQ is calculated as a weighted composite of various subtests, IQ is related to the underlying general mental ability. This underlying "general mental ability" is often called *g*, which has the advantage that it is far less incendiary than IQ, even though it is functionally equivalent. Yet *g* is also a statistical abstraction, rather than a direct measure of a definable mental ability.

The general factor *g* is defined as that component of mental ability that is common to all intelligence tests.[39] Every reliable test of mental ability measures *g* to some extent, although the degree of correlation with *g* can vary. The tests that best measure *g* involve complex cognitive tasks. Tests that are less complex are less able to measure *g* because they tend to involve simple mental tasks such as sensory discrimination, reaction time, or rote memory. The *g* factor is of interest because it is not a measure of a specific knowledge, skill, or strategy, but rather reflects individual differences in the speed of information processing. In fact, some people believe that *g* is actually a measure of a physiological process, such as the speed of conduction of nerve impulses in the brain. The extent to which IQ tests are worthwhile is thus determined by only two considerations:

(1) How well does a specific test measure *g*? and (2) How well does *g* determine actual performance at school or at work?

The different subtests on an intelligence exam seek to characterize three basic sets of skills.[38] Verbalization skills are concerned with vocabulary, word use, paragraph comprehension, and so on, while visualization skills involve the mental manipulation of visual patterns. A third category of abstraction skills pertain to reasoning, problem-solving ability, and the ability to find and complete a pattern implicit in a series of related objects. These three sets of skills are clearly complementary to one another, and all are more or less related to *g*. In a sense, measuring these separate abilities in order to characterize *g* is somewhat like measuring arm and leg strength to assess muscular strength. A person can have arm or leg function impaired by some factor unrelated to muscle strength, but usually arm and leg strength are a good indicator of general muscular strength. But, possessing great muscular strength will not, in and of itself, make someone an athlete, just as having a high IQ will not guarantee success in life.

Intelligence is perhaps best defined as the ability to solve problems quickly and efficiently. Life often seems to be an endless series of problems, so a great premium is placed on an ability to solve these problems in the time allotted. To achieve great success in life, a person must possess at least a modicum of intelligence, but that is clearly not enough. Intelligence must be complemented by perseverance, self-confidence, and energy, and great intelligence often cannot overcome poor health, laziness, poor social skills, or a lack of initiative.

Can Intelligence Be Accurately Measured?

If intelligence is defined as the ability to solve problems, then in principle it should be possible to measure intelligence using a carefully posed set of problems. This is the basic rationale for all mental testing, and most psychologists argue that current mental tests are capable of measuring intelligence with acceptable

accuracy. In fact, a letter published recently in *The Wall Street Journal* and signed by 52 of the most prominent experts in intelligence[40] stated that "intelligence . . . can be measured, and intelligence tests measure it well. They are among the most accurate (in technical terms, reliable and valid) of all psychological tests and assessments." The authors added that "while there are different types of intelligence tests, they all measure the same intelligence." There are some dissenters from this majority viewpoint, but the important point is that consensus has largely been achieved.

One of the best-known dissenters is Howard Gardner of Harvard University, who argues that there is no general mental ability *g* that can be measured by a test of logical thinking.[37] Instead, Gardner argues that there are seven distinct types of intelligence: linguistic, musical, spatial, logical-mathematical, bodily-kinesthetic, intrapersonal, and interpersonal. Critics have argued that this simply broadens the definition of intelligence to include what might more properly be called talents, but Gardner responds that language and logical thinking are also just talents. Gardner's argument is somewhat appealing, but the majority of scholars now endorse *g* as adequate to describe intelligence.

A fascinating feature of the human brain is that neurologic damage can essentially delete certain mental abilities. Stroke, brain injury, or the growth of a brain tumor can produce damage in a small portion of the brain, and such damage can cause a person to lose a small portion of his normal repertoire of behavior. Oliver Sachs, the neurologist who wrote *The Man Who Mistook His Wife for a Hat*, has reported several bizarre neurologic syndromes, of interest not because they are common, but because of what they reveal about the workings of the normal human brain. For example, Sachs describes a patient who is wonderfully articulate but cannot think of the name of any common objects; once the object is named, though, he is able to recognize it and use it as would a normal person. Another patient has no recollection whatsoever of the last 40 years of his life, although he remembers the first 20 years of his life in vivid detail. Yet another patient is unable to understand the meaning

of words, but is able to read the subtext of speech, written on the face of the speaker, with uncanny accuracy. These bizarre deficits demonstrate that abilities such as word recollection, memory, and verbal comprehension have distinct loci within the brain, and that it is possible to lose an ability without being otherwise impaired. These deficits also suggest that different mental abilities, which are ordinarily very closely related to one another, can sometimes come "uncoupled" in an individual patient, as a result of structural brain damage. These considerations are not really relevant in the vast majority of people, but they do imply that we perhaps have a simplistic definition of intelligence.

Does Intelligence Correlate with Performance?

If our current definition of intelligence is perhaps flawed, we must ask the question, to what extent does measured intelligence predict success in life? Perhaps the best source of data relating to this question is the National Longitudinal Survey of Youth, a study organized by scientists at the University of Chicago.[41] This study has followed more than 10,000 children for up to 27 years, measuring intellectual and socioeconomic variables all the while, and it is widely recognized as the best longitudinal data in the country. The study, which originated under the patronage of the Bureau of Labor Statistics in the mid-1960s, is actually several separate longitudinal surveys, some of which have been discontinued. The longest continuing study was begun in 1968, and includes a sample of women then between the ages of 14 and 24. In 1979, another group of 15,000 young people between the ages of 14 and 21 was surveyed; this group is known as NLSY79 and is the study group used in *The Bell Curve* analysis. Although budget constraints in the early 1980s caused the study population to be reduced to 10,000, these participants are still active in the study.

At the inception of the NLSY79 study, participants were surveyed to collect a wide range of data on attitudes and demographics. Each participant completed questionnaires relating

to parental socioeconomic status (SES), childhood environment, and religious beliefs, and each person also took the Armed Forces Qualification Test, a widely accepted measure of IQ. These participants have been interviewed annually, as their life unfolds, and now more than 7000 children, born to the original participants, are also enrolled in the study. This data base is an absolute gold mine of information; more than 2400 books, newspaper articles, and dissertations have been written about the study participants, and the survey will become progressively more valuable with time as study participants age.

The NLSY79 data base was analyzed by Richard Herrnstein and Charles Murray as a part of *The Bell Curve*,[37] to determine the relationship between IQ and various measures of success in life. Low IQ can be thought of as a "risk factor," or a factor that predisposes someone to a risk such as failure to finish high school. (For our purposes, a person of below-average intelligence is defined as someone with an IQ from 75 to 90, while a person of above-average intelligence is defined as someone with an IQ from 110 to 125.) It is then possible to calculate whether a person with low IQ is more vulnerable to the vagaries of life using the following method. If a person of below-average intelligence has a 10% chance of engaging in some particular behavior, while a person of above-average intelligence has a 2% chance of engaging in the same behavior, then low IQ is associated with a 5-fold increase in relative risk of that behavior (10% divided by 2% = 5). In this way, the relative risk of various misfortunes can be calculated as a function of IQ.

The NLSY79 data base shows that poverty is more than 5fold as common among whites of below-average intelligence, compared to whites of above-average intelligence. Compared to a white person of above-average intelligence, a white person of below-average intelligence is: 70-fold more likely to drop out of school without obtaining a high school diploma; eightfold more likely to go on welfare; seven-fold more likely to go to jail; fivefold more likely to live in poverty; fivefold more likely to raise children in an unsatisfactory environment; fourfold more likely to bear illegitimate children; twice as likely to have children with major behavioral problems; twice as likely to be job-disabled; and almost twice as likely to be unemployed.[37] It could well be argued that most of these misfortunes are predicated on the inability to obtain a high school diploma, but this does not change the fact that a person of below-average intelligence is 70-fold more likely to drop out and thereby put himself at risk for all of these contingent problems.

These findings are not unique; a good deal of evidence exists that high IQ is associated with greater success in life. For example, a study in Norway examined both identical and fraternal twins, to determine whether IQ is correlated with educational attainment or occupational status.[42] It was found that the correlation between IQ and education was 0.52, meaning that about 25% of the variability in educational status could be explained on the basis of IQ alone. Similarly, the correlation between IQ and job status was 0.33, meaning that at least 10% of the variability in job status could be explained by IQ alone. While 10% may not seem like much, it should be remembered that this ignores the contribution of health, education, and hard work to job status. On the basis of these results, it was calculated that the heritability of IQ is about 66%, while the heritability of educational level is 51%, and the heritability of SES is 43%. Scientists thus concluded that IQ is largely responsible for both educational attainment and job status.

The Genetics of Intelligence

Deciphering the genetics of intelligence is difficult because intelligence is so all-pervasive, both in defining our world view and in structuring our society. Rightly or wrongly, a person tends to be sorted on the basis of intelligence early in life, so that the majority of people one encounters on a day-to-day basis are of roughly comparable intelligence. This self-sorting and sorting-by-society extends from early school-age to old age, from self-selected classes in junior high school to occupational roles in adulthood,

from one's choice of a spouse to one's circle of friends. Because human society is, to a certain extent, structured by intelligence, some of the assumptions that are routinely made by geneticists trying to decipher the heritability of a trait are violated. For example, virtually all of our understanding of genetics is based on the idea that mating between individuals is random. Yet we know that intelligence is often used as a basis for selecting a spouse. There is usually a very good correlation between the IQ of spouses, so this necessarily means that the assumption of "assortative mating" is violated, at least for IQ.[43]

Understanding the genetics of intelligence is complicated by the fact that intelligence is apparently not inherited as a unit, so that it is possible to inherit different aspects of the intelligence of your parents. For example, verbal and spatial memory are as strongly heritable as is overall IQ, but there is evidence that memory may be considerably less heritable.[43] Deciphering the inheritance of a complex trait like intelligence is doomed to almost certain failure when using ideas developed from analyzing the inheritance of simple traits. Yet the complexity of human intelligence may be less of a problem than it seems at first, because many aspects of intelligence are inadequately assessed by intelligence tests. If a particular test is unable to identify someone who is very gifted musically, then the test will also miss this ability in all other subjects. Therefore, while our understanding of intelligence may be too simplistic, this understanding is probably comparably simplistic for all people. A major problem would occur only if a particular intelligence test was able to measure ability in some, but not all, subjects.

Many genes are apparently involved in determining intelligence, so the specific contribution of any one gene is rather small.[44] A recent study of children with low, medium, and high IQ has suggested that there is at least one major gene involved in producing great intelligence, but this idea is really quite speculative at present.[22] In truth, no one has the slightest idea how many genes are involved in producing a person of great intelligence. But it is a fair bet that someone of moderate intelligence is produced by relatively fewer favorable genes than is someone of great intelligence. While each gene may have a small impact on intelligence, the cumulative effect on IQ could be quite large.

Finally, the expression of intelligence is very much at the whim of external circumstances, and even somewhat at the mercy of internal circumstances. As we have seen, childhood exposure to lead in the environment can lower intelligence in even the most supportive intellectual circumstances. Since most intellectual circumstances are less than completely supportive, it is quite likely that the environment routinely conspires to produce a lower intelligence than is specified by the genes alone. And different genes interact with each other in ways that are far from predictable. One gene may be dominant to another, or to a whole series of other genes, while certain genes may subtly modify the expression of even a dominant gene.

As an example of the genetic complexity of intelligence, there is evidence that mathematical intelligence is, to at least some extent, sex-linked.[45] This means that, in an unknown way, genes that determine an individual's sex interact with genes associated with the ability to do mathematics. This was shown clearly in a study of 9927 intellectually gifted junior high school students, each of whom took the Scholastic Aptitude Test, a test that is normally intended for college-bound juniors and seniors. It was found that boys scored, on average, about 40 points higher than girls on the mathematical part of the test, even though boys and girls, at that point, had the same amount of formal training in mathematics. In other words, a substantial difference in mathematical ability existed between boys and girls before this difference could be attributed to different courses of study. The differences between boys and girls in mathematical ability could not be attributed to overall differences in intelligence, since boys and girls scored equally well on the verbal part of the examination. It is also unlikely that this difference was related to differences in environment or socialization prior to testing, since no such differences could be found. Instead, it was concluded that sex differences in mathematical achievement result from an innately superior mathematical ability in males; this is consistent with a previously known greater ability of males in spatial tasks.

Table 1
Correlation of IQ in Identical Twins Reared Apart[a]

	Correlation	No. of pairs	Year of study	Range of correlation
	71%	19	1937	68–74%
	75%	37	1962	74–76%
	69%	12	1965	64–73%
	75%	42	1990	69–78%
Average	74%			

[a]The average correlation shown is a weighted average calculated from all large studies of identical twins.[8] Correlation is a mathematical expression of the degree of similarity, where 100% indicates identity and 0% indicates no similarity whatsoever. In the special case of identical twins reared apart from infancy, the correlation of IQ between twins is equivalent to heritability of IQ, since there is no shared environment.

With all of the confusion surrounding the genetics of intelligence, it is a wonder that the role of genes in determining intelligence can be discerned at all. But, as always, the split twin experiment has proven to be critical; first, in distinguishing that there is a very powerful influence of genes on intelligence, and second, in helping to discern the relative role of genes and the environment (Tables 1 and 2). A compilation of the available data suggests that the intelligence of identical twins reared apart is very closely correlated, even though these children share no environment whatsoever.[8]

What Is the Heritability of Intelligence?

The heritability of a trait is normally determined in one of three ways. The direct method of determining heritability relies on determining the correlation between the intelligence of identical twins reared apart (Table 1). Correlation is a mathematical expression of the degree of similarity, where 100% indicates identity and 0% indicates no similarity. This approach is based on the assumption that, in the special case of identical twins reared apart from infancy onwards, the correlation of IQ

Table 2
Average Correlation of IQ in Families[a]

Relationship	Correlation	No. of pairs	Range of correlations
Same person tested twice	90%	88	NA
Identical twins reared together	86%	4,672	58–95%
Identical twins reared apart	72%	110	69–75%
Fraternal twins reared together	60%	5,546	20–87%
Fraternal twins reared apart	52%	34	NA
Siblings reared together	47%	26,473	11–90%
Siblings reared apart	24%	203	23–25%
Parent and offspring reared together	42%	8,433	5–87%
Parent and offspring reared apart	22%	814	9–38%
Adoptive siblings reared together	29%	345	5–38%
Spouses	33%	3,817	16–74%

[a]Data from 111 separate studies of intelligence, involving more than 113,942 pairwise comparisons (e.g., identical twins to each other or mother to daughter), collated from the literature,[44] and supplemented where necessary.[51] Heritability calculated from these data are: by the direct method, 72% (i.e., identical twins reared apart); or by the indirect method, 52% [i.e., twice the difference between identical twins reared together (86%) and fraternal twins reared together (60%)]. The average correlation between spouses for intelligence is higher than for almost all other traits; this indicates that IQ is responsible for assortative mating and suggests that first-degree relatives are more similar for IQ than for most other traits. It is of interest that fraternal twins are no more similar to each other genetically than are full siblings, even though the IQ of fraternal twins is much more similar.

between twins is equivalent to the heritability of IQ, since there is no "shared environment." By this logic, the heritability of intelligence is 74%,[8] since intelligence was 74% similar between identical twins in a sample of 110 twin pairs. In other words, 74% of the variation in intelligence of identical twins could be

explained on the basis of genes alone, without any contribution from the environment. This means, of course, that the remaining 26% of the variation in intelligence must be a result of environmental factors. This estimate sets the upper bound of plausibility, because identical twins reared apart do share some amount of environment, even if they are reared apart. This is because identical twins reared apart are free to construct their own environment to a certain extent, and the choice of personal environment is influenced by the genes. In addition, children born at the same historical moment are very likely to share elements of the environment external to the home, as noted earlier. The bleakness of the Great Depression, the hopefulness of the era of space exploration in the 1960s, and the unconstrained greed of the 1980s all must have some effect on a child. Therefore, we regard the actual heritability of intelligence as something less than 74%.

The indirect method of determining heritability relies on determining the correlation between identical twins reared together and fraternal twins reared together (Table 2). Heritability is then calculated by subtracting the IQ correlation for fraternal twins from the IQ correlation for identical twins, and doubling the result. By this logic, the heritability of intelligence is about 52%.[22,43] But the IQ of fraternal twins tends to be more closely correlated than the IQ of other (nontwin) siblings, even though fraternal twins are, genetically speaking, no more closely related than other siblings. This implies that there is more "shared environment" for fraternal twins than for other siblings, and that fraternal twin environment is more concordant than normal. Thus, the indirect method of calculating heritability may underestimate the influence of this "shared environment." There is an uncertainty built into the indirect estimate of heritability, meaning that true heritability must fall somewhere within the range of 30 to 70%, but it is problematic to determine heritability any more exactly.

There is also reasonably good evidence that heritability varies with age.[46] The Colorado Adoption Project, which was initiated in 1975, tested the intelligence of biological parents and their children given up for adoption, and it also tested the intelligence of adoptive parents. Children were tested repeatedly at 1, 2, 3, 4, and 7 years of age, and the correlation between children and their biological and adoptive parents was analyzed. From the correlation between children and their biological parents, it was calculated that the heritability of intelligence was only 9% at age 1. But heritability increased progressively with increasing age, as the genes were given time to assert themselves. By age 4, heritability was 20%, and reached 36% at age 7. Studies that examined older children imply that heritability reaches 45–51% by late adolescence,[47] and may reach 80% late in life.[2] Of course, these findings may simply mean that the tests given to very young children are flawed; as children grow older, the tests used are less flawed, so that the intellectual similarities which were always there just become more apparent. Nevertheless, this study suggests that both genes and the environment are important in determining intelligence in the teenage years, but that genes can make an additional contribution to intelligence as children grow older.[47] This confusing picture does not make it any easier to arrive at a simple estimation of the heritability of intelligence.

Furthermore, the heritability of intelligence may differ by intelligence level. One study that examined identical and fraternal twins concluded that the heritability of intelligence was higher for high IQ, meaning that intelligence is more nearly hereditary than is stupidity.[48] But another study concluded exactly the opposite, that the heritability of IQ is greater for low IQ.[43] This seems to be somewhat easier to rationalize, as it implies that one can inherit a vulnerability to low intelligence, much as one can inherit a vulnerability to Alzheimer's disease. All we can do at this point is to restrict ourselves to determining average heritability of the average IQ at an average age of about 30.

Mathematical analysis suggests that heritability will consistently differ when calculated by the indirect and direct methods.[43] In general, heritability calculated by the direct method tends to be higher than that calculated by the indirect method.

The differences do not appear to be related to such factors as selective placement of adoptees with adoptive parents of similar intelligence, or other interactions between genes and the environment. Instead, analysis suggests that the subtle similarity of environmental factors within a family is important in determining intelligence.

Given these uncertainties, mathematical models of inheritance may be needed to obtain a good estimate of the heritability of intelligence. A great deal of effort has been devoted to making such models, and to incorporating new data into the models, to get a good estimate of heritability. To make a long story short, a current mathematical model estimates that the heritability of intelligence is between 47 and 58%.[27] Another similar model has arrived at an estimate of between 54 and 64%.[49] On balance, we take the average heritability of intelligence to be 60%; this estimate is necessarily tentative, but it is likely to be fairly conservative for a mature adult. This means, of course, that 40% (or more than one-third) of the average intelligence can be attributed to differences in environment. This must mean that the environment is critically important in determining intelligence; a potentially brilliant child in a depauperate environment may lose all hope of brilliance, while an average child, lacking an adequate education, may become functionally well below average.

Heredity and Environment Interact Strongly

Mathematical models of the heritability of intelligence suggest that environmental factors within the family are important in determining intelligence. This conclusion, as simple as it seems, has never been thoroughly tested by scientists. There is really only one study that tries rigorously to partition the impact of heredity and environment on IQ.[50] This study used a very ingenious study plan (known as a cross-fostering design), to show that heredity and environment are each critical in determining IQ (Table 3).

Table 3
IQ of Adopted Children[a]

		SES of adoptive parents		
		High	Low	Average
SES of biological parents	High	120	108	114
	Low	104	92	98
	Average	112	100	

[a]Data from a cross-fostering study involving a total of 38 children.[50] Effects on IQ related to socioeconomic status (SES) of both the biological and adoptive parents are very significant, although the effect of the biological parents SES was more significant.

This important study set out to assess the effect of socioeconomic status (SES) on IQ, by determining how the IQ of adopted children is affected by the SES of their parents.[50] Rigid criteria were used to identify study cases, born in France between 1970 and 1975, who were given up for adoption when quite young. The SES of biological and adoptive parents was scored objectively as being either high, medium, or low, then all parents of medium SES were excluded from further consideration. This was done simply to contrast extremes, to maximize the chance of being able to discern a role for SES. Adoption records were sought specifically for low-SES children who were adopted by low- and high-SES parents, in order to determine whether exposure to a high-SES environment could increase IQ. Similarly, records were sought for high-SES children who had been adopted by low- and high-SES parents, to determine whether exposure to a low-SES environment could reduce IQ. More than 600 adoption records were reviewed, to identify ten adopted children who fit into each of these four rigid types. Then the IQ of each of these adopted children was tested.

Overall, it was found that the IQ of children born to high-SES parents is almost 16 points higher than that of children born to low-SES parents (Table 3). Conversely, the IQ of children adopted by high-SES parents is about 12 points higher than that of children adopted by low-SES parents. Obviously, it is best to be born to parents of high SES and then adopted by parents of

high SES; the average IQ of children who fit this profile is an impressive 120. It is worst to be born to parents of low SES and then adopted by parents of low SES; the average IQ of children who fit this profile is only 92. But a child born to low-SES parents and adopted by high-SES parents could count on having an IQ more than 11 points higher than a similar child adopted by low-SES parents. Similarly, children born to high-SES parents who were adopted by high-SES parents could count on having an IQ more than 12 points higher than a similar child adopted by low-SES parents. What all of this means is that both genes and the environment are critical in producing an intelligent child. On average, high SES of the biological parents was sufficient to raise the IQ of the children by nearly 16 points. But high SES of the adoptive parents was sufficient to raise the IQ of the children by about 12 points. As we shall see at the conclusion of this chapter, a difference of 12 IQ points can make a tremendous difference in the quality of life.

This is a wonderfully clear demonstration of what we have always intuitively known: both genes and the environment must be adequate to produce an intelligent child. These results could not be explained on the basis of differences in health of the children, since the birth weight, the length of pregnancy, and the prevalence of newborn illnesses were comparable among the four groups. The fact that such a clear result could be obtained without studying identical and fraternal twins is also refreshing; one begins to suspect that it is possible to overdo twin studies. From a genetic standpoint, it is also interesting that the effect of high SES of the adoptive parents was very similar for children born to either high- or low-SES parents; in both cases, high SES of the adoptive parents raised IQ by roughly 12 points. This warrants the simple conclusion that SES alone can account for an approximate 12-point swing in IQ. In this context, it is very interesting that *The Bell Curve* concludes that the average IQ difference between blacks and whites is 15 points. It is perhaps no coincidence at all that the racial difference in IQ is almost identical to the SES difference in IQ.

How *The Bell Curve* Is Wrong

The Bell Curve contends that intelligence is a critical factor in explaining many features of our society beyond simply educational success and occupation. Intelligence is also invoked to explain features of society such as rates of divorce, illegitimacy, unemployment, welfare dependency, poverty, and crime. It is argued that various ethnic groups differ in average intelligence, and that intelligence is an evermore-critical factor in structuring American society. Data are abstracted from the National Longitudinal Survey of Youth (NLSY) to show that there is a relationship between intelligence and the patterns of life in America. The authors then describe social programs they believe to be justified on the basis of the importance of intelligence in structuring society. They contend that intelligence cannot be increased significantly by environmental improvement, saying that ". . . the story of attempts to raise intelligence is one of high hopes, flamboyant claims, and disappointing results. For the foreseeable future, the problems of low cognitive ability are not going to be solved by outside interventions to make children smarter" (p. 389). Because they perceive intelligence to be an immutable property of the individual, social stratification on the basis of intelligence is seen as inevitable, perhaps even beneficial, for American society. The authors conclude by arguing strongly against affirmative action, in colleges and in the workplace, because they believe it to be "leaking a poison into the American soul" (p. 508).

This book has been given a poor reception by most members of the intellectual community. Many negative reviews of the book have appeared, but these reviews are often flawed in the same way that *The Bell Curve* itself is flawed. Both the book, and most reviews of it, are written as polemics, in the sense that they are concerned more with bludgeoning an alternative viewpoint than with discerning the truth. In fact, the early part of *The Bell Curve*, where data from the NLSY are analyzed, does a better job of marshalling evidence than a good many critics were able to

do. The most critical reviews are often very poorly done; some of them are simply an emotional denial of the book, without a serious consideration of its content, while others are the result of reflexive and somewhat myopic liberalism, not intellectual criticism.

Nevertheless, *The Bell Curve* is very seriously flawed; while the data from the NLSY seem, for the most part, to be well analyzed, there is still a huge leap involved in going from these facts to the interpretation given them. As a letter in *The Wall Street Journal*, signed by 52 leading experts in intelligence, notes, ". . . research findings neither dictate nor preclude any particular social policy, because they can never determine our goals."[40] In other words, research findings are (if we are lucky) facts, while social policies can be no more than interpretations given to those facts. This distinction between fact and interpretation is a very critical one, especially for a scientist; basically, facts don't change, but the interpretation given to them can change radically. A scientist must be extremely careful in going beyond the data to synthesize and generalize, and even more careful when presenting generalizations to a lay audience that is perhaps less aware of the distinction between fact and interpretation. Many scientists would argue that it is inappropriate for someone trained in science to make pronouncements about public policy at all. However, we believe that if scientists fail to make public policy recommendations based on good science, then politicians will make them based on bad science.

In short, *The Bell Curve* would be a better book if it had three parts, each clearly separated from the other, and each designed to answer a single question, as follows:

1. What is the pattern? What is the evidence that intelligence is correlated with other key societal variables, including divorce, illegitimacy, unemployment, welfare dependency, poverty, and crime? *The Bell Curve* actually does quite a good job answering this question.
2. How was this pattern established? If intelligence is found to be important in structuring American life, one must address the genesis of intelligence. If nature alone determines intelligence, then a defeatist tone is perhaps appropriate, but if nurture also determines intelligence, then giving up on the disadvantaged is totally unjustified. The book fails to address the genesis of intelligence adequately.
3. What should we do about the pattern? This is clearly a public policy issue, so this section of the book would necessarily be interpretative, but it should also be firmly grounded in facts collated in the preceding two parts, and interpretations should be clearly acknowledged as such. The book also fails to answer this question, because it freely mingles fact and interpretation in a very volatile fashion.

In our estimation, *The Bell Curve* is seriously flawed in two ways: it first misconstrues a very critical fact, and it then fails completely to indicate where fact stops and interpretation begins. The critical fact misconstrued in *The Bell Curve* is the meaning and importance of heritability. The authors first acknowledge that intelligence is only about 60% heritable, but they later state, as quoted above, that intelligence is basically immutable. A heritability of 60% means that genes are more important than environment in determining intelligence, but it also means that environment absolutely does have a role in determining intelligence. Genetics may determine the range through which environment can modify a trait such as intelligence, but genetics cannot preclude the environment from having a very potent impact on intelligence. To conclude that a trait that is only 60% heritable is also immutable is a very grave error. It is an especially critical error because the authors prescribe a social program based on their naive conception of heritability.

The authors of *The Bell Curve* state openly that the heritability of intelligence is 60%, but through much of their discussion they seem to tacitly assume that heritability is actually closer to 80% or even 100%. Unless one assumes that DNA is destiny, how can one rationalize the statement that "formal schooling offers

little hope of narrowing cognitive inequality" or that "the problems of low cognitive ability are not going to be solved by outside interventions to make children smarter" (p. 389)? The authors also say that "the more one knows about the evidence, the harder it is to be optimistic about prospects in the near future for raising the scores of the people who are most disadvantaged by their low scores" (p. 390). There is a message of profound pessimism here that has not been lost on the media. Yet just because we have failed in the past to raise intelligence by environmental enrichment does not mean that we will always fail. Clearly, there is a role for genetics in establishing the patterns noted in *The Bell Curve*, but just as clearly, the pattern was established and is maintained by systematic discrimination against the poor and disenfranchised.

A seemingly small change in average IQ of a group can produce rather radical changes in social behavior, according to no less an authority than *The Bell Curve* (p. 368). The mean IQ of children in the National Longitudinal Survey of Youth was about 100, as it is expected to be in any large random sample of people in the United States. If this mean is altered by only 3 points, to 97, by randomly excluding some of those people who pull the average IQ up to 100, then there are a number of striking changes in social problems. As the IQ falls by only 3 points, the number of women ever on welfare increases by about 13%, the number of men ever incarcerated increases by about 11%, the number of people below the poverty line increases by about 10%, and the number of children born out of wedlock increases by about 7%. If a similar manipulation is done to raise IQ by only 3 points, to 103, by excluding those people who pull the average down to 100, there is a striking reversal of these social problems. As the IQ increases by only 3 points, the number of women ever on welfare decreases by about 19%, the number of men ever incarcerated decreases by about 25%, the number of people below the poverty line decreases by about 26%, and the number of children born out of wedlock decreases by about 17%. Is it any wonder, then, that the 15-point IQ difference between blacks and whites, so forcefully noted by *The Bell Curve*, is associated with grave social problems which impact the black community?

In reality, the problems epidemic in the ghetto are likely not racial in origin, and they cannot be lessened by "solutions" that increase racial disparity in SES. Disparity in social environments could easily account for the IQ differences described in *The Bell Curve*, and they could as easily account for differences in social problems such as drug use, alcoholism, and violence. Official policy that would perpetuate these inequities is simply lighting a fuse to an already explosive situation. The social programs suggested in *The Bell Curve* are intellectually bankrupt and morally indefensible; they resolve nothing, they merely validate an inclination to ignore the problem. By advocating benign neglect as an appropriate response to poverty and social disenfranchisement, Herrnstein and Murray have simply given up on the problem, and thereby done immense harm to a large number of people. But great minds don't give up on a problem just because the problem is difficult.

As an ironic aside, in a perfect world where environment is equally enabling for everyone, the heritability of intelligence would actually increase. If differences in environment do not exist, then genetics must explain 100% of the IQ differences among people. Thus, we do not imagine that all obstacles to achievement for all people will be removed by making a world where the environment is equally enabling for everyone. Instead, intelligence must be recognized for what it is: a gift of grace. Those blessed with intelligence should work very hard to make a better world for all, because inherent in the belief that intelligence is a gift is the idea that the gift bears certain responsibilities.