Increasing the Raw Intelligence of a Nation is Constrained by Ignorance, Not its Citizens' Genes

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Abstract:

In *The Bell Curve*, Herrnstein and Murray claim that a high value for heritability of intelligence limits or constrains the extent to which intelligence can be increased by changing the environment. This article argues that the concept of heritability is based on unsupportable assumptions and that its numerical value places no constraint on the consequences of an improved environment. On the contrary, a very small change in environment, such as a dietary supplement, can lead to a major change in mental development, provided the change is appropriate to the specific kind of deficit that in the past has impaired development. The results of adoption studies and the intergenerational cohort effect also reveal that intelligence can be increased substantially without the need for heroic intervention.

Article:

The Bell Curve by Herrnstein and Murray (1994) addresses what they and many politicians perceive as a crisis in the United States brought about by wrong-headed government policies, policies they claim have resulted in "disaster," and they urge that government leaders should "try living with inequality" rather than striving to eradicate it. They believe that many people lack sufficient intelligence to be successful in American society, and they argue that an important part of their inability to compete successfully arises from inadequate genes.

Even before it appeared in retail stores, the book was prominently publicized in the mass media as offering important insights about genetic causes of low intelligence and poverty. The October 16, 1994 issue of the *New York Times Book Review* featured *The Bell Curve* with a cover picture of a DNA double helix and the question "How much of us is in the genes?" Inside was a sympathetic review (Browne, 1994) emphasizing "ineradicable cognitive disability created by genetic bad luck" (p. 3). Although data in the book are almost exclusively concerned with the United States and the obsession with race is a peculiarly American trait, *The Bell Curve* was given major, albeit more critical, attention in national Canadian media (Bruning, 1994; Campbell, 1994). After a remarkably short delay, multiauthored, book-length discussions of *The Bell Curve* went on sale (Fraser, 1995; Jacoby & Glauberman, 1995). Herrnstein and Murray wrote a deliberately provocative book and in this respect they succeeded marvelously. Vast numbers of intellectuals in Canada and the US have set aside their work for a while and occupied their minds with genes and psychological testing. Although the book was not written to advance scientific knowledge and will not have much appeal for those in the biological sciences in particular, it has become necessary for many of us to examine it in some detail because of persistent questions about it from colleagues and journalists.

As a specialist in behavioral and neural genetics, I focused on those chapters involving claims about heredity and inequality. Herrnstein specialized in the study of learning in rats and pigeons, whereas Murray is a political scientist. Herrnstein and Murray are obviously not geneticists: they are writing for an audience that knows little about genetics, and their readers will not gain a better understanding of genetic principles from reading their book. On the contrary, diligent readers who try to follow their reasoning will probably become confused and misled about the role of genes and the root causes of social problems.

Herrnstein and Murray claim that statistical methods can reveal with reasonable accuracy the percentage of individual variation in intelligence that is caused by genetic differences among people, and they conclude that the "most unambiguous direct estimate" indicates this percentage is about 60-70%. They do not mention that this methodology presumes the effects of genes and environment occur separately during development and combine by simple arithmetical summation, or that this presumption has been rejected as biologically unrealistic by many geneticists (Gottlieb, 1992; Lewontin, 1974; McGuire & Hirsch, 1977; Wahlsten, 1990, 1994). They claim that high "heritability" of IQ means that improving the environment of a poor child a modest amount will be ineffective because "such changes are limited in their potential consequences when heritability so constrains the limits of environmental effects" (p. 109).

The Bell Curve is simply wrong on this point. A heritability estimate does not in any way constrain the effects of a moderately changed environment. Small treatments tend to have small effects unless the treatments directly and precisely ameliorate a specific difficulty that impairs development. If such a specific difficulty can be identified, a very small change in the environment can lead to a dramatic improvement. For example, during the first few decades of the 20th century, pellagra was quite common among the working poor of the southern US. The eugenicist Davenport claimed the slow learning and health problems of pellagrins resulted from an infection combined with bad genes, while the experimental *proof* by the physician Goldberger that it was a vitamin deficiency disease caused by low wages leading to a poor diet was ignored (Chase, 1977). Now we know that a small daily dose of the vitamin niacin can effectively prevent pellagra, just as vitamin C prevents scurvy and low phenylalanine milk prevents symptoms of the genetic disease phenylketonuria (PKU). Sweeping statements about the ineffectiveness of environmental change denote helplessness and pessimism occasioned by ignorance rather than any inherent resistance of intelligence to modification. Each of the 50,000 or more genes in the human chromosomes functions in a highly specific way as part of the biochemical system of a cell, and genetic knowledge can help to devise effective treatments only when a specific gene that impairs development is known. Bereft of genuine genetic knowledge, the kind of pseudogenetic heritability estimates espoused by Herrnstein and Murray serve as a weapon against the poor in the propaganda arsenal of reactionary politicians.

The Bell Curve asserts confidently that "Changing cognitive ability through environmental intervention has proved to be extraordinarily difficult" (p. 314). This is false. Available data indicate that a modest, short term improvement such as the Head Start project in the US has correspondingly small effects on mental ability test scores, whereas a large and lasting improvement produced by adoption can exert quite a large effect. Well-controlled studies done in France have found that transferring an infant from a family having low socio-economic status (SES) to a home where parents have high SES improves childhood IQ scores by 12 to 16 points or about one standard deviation (Capron & Duyme, 1991; Schiff, Duyme, Dumaret, & Tomkiewicz, 1982; see Figure 1), which is considered a large effect size in psychological research (Cohen, 1988). Adoption can entail a major improvement in a child's environment, but the adoptive home is usually not off the scale of decent environments and therefore is not expected to yield a rich harvest of superior intellects. Achieving extraordinarily high levels of performance requires exceptional effort under the tutelage of expert instructors (Ericsson, Krampe, & Tesch-Romer, 1993; Wagner & Oliver, in press). Outstanding achievement and brilliant creativity do not come "naturally" to anyone merely because of their genes.

Changing mental ability test scores a modest amount is not so difficult. In fact, routine IQ testing reveals this commonly happens without deliberate intervention to enhance intelligence per se. The extent of this phenomenon tends to be obscured by the method of scoring the tests. The average IQ in a population should be about 100 and the standard deviation should be about 15, such that about 98% of people at the same age will score between 70 and 130 IQ points. One mechanism for scaling an IQ test is simple. The test is given in a particular year to a representative random sample of the population, and the numbers of items correct have mean and standard deviation of M and S, respectively. Then each raw score X is converted to a standard score Z that represents the number of standard deviations from the mean for the individual, using Z=(X—M) /S. The Z scores have a mean of 0 and standard deviation of 1. Finally, the Z scores are transformed to IQ scores with the formula IQ=100+Z(15). Thus IQ indicates relative performance on a test rather than absolute degree of intelligence. Over a period of several years it becomes necessary to restandardize the IQ test using more

appropriate test items and a new sample of the population. This periodic restandardization of a test tends to keep the mean IQ close to 100, even if the underlying trait called intelligence is changing substantially in the population.

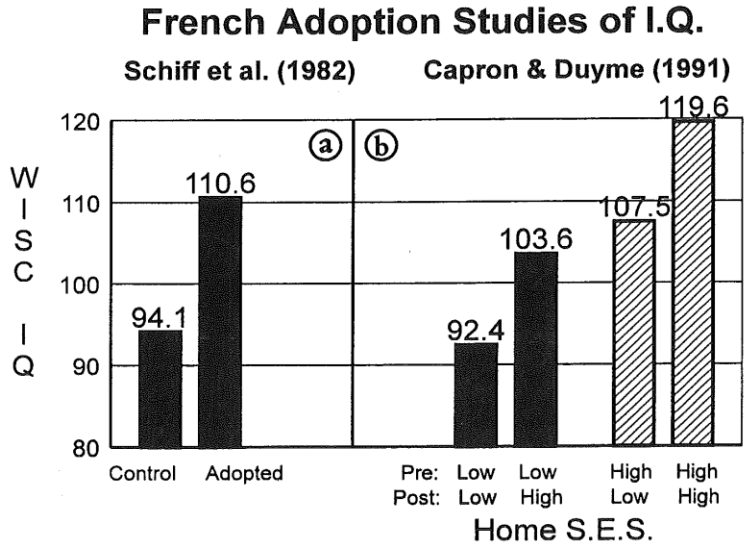

Figure 1. Mean WISC IQ score for children in two adoption studies done in France. (a) Schiff et al. (1982) compared two groups of children having the same biological mother and similar biological fathers. One group had been adopted into homes of well-educated professionals, whereas the control children had remained with the mother living in poverty. (b) Capron and Duyme (1991) tested children from four conditions categorized according to parental socioeconomic status (SES) prior to and after adoption.

An immense body of evidence reveals that raw, unstandardized intelligence has been gradually increasing for several decades-since World War II in many industrialized countries including Canada (Flynn, 1987). Two kinds of data show this trend clearly. Perhaps the most persuasive comes from the Netherlands, an ethnically homogenous country, where almost all 18-year-old males are given the Raven's Progressive Matrices test as part of military induction. The test itself has not been modified for several decades. As shown in Figure 2, there is a very large *cohort effect* amounting to 21 IQ points increase in the population over three decades.

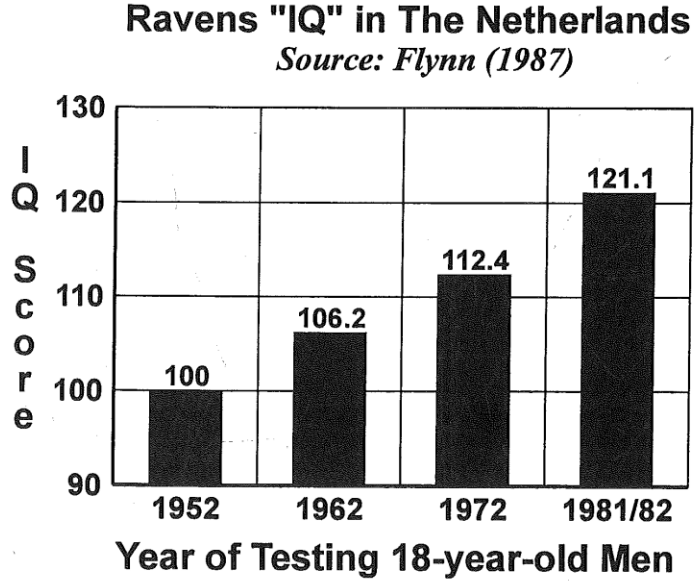

Figure 2. Mean Raven's Progressive Matrices scores converted to IQ scores for 18-year-old men in the Netherlands who were tested at the time of military induction in different years. Based on data in Table 1 of Flynn (1987).

The other kind of evidence derives from the restandardization procedure when people given the new version of a test then take the old version so that validity can be assessed. For example, when the Wechsler Intelligence Scale for Children (WISC) was revised in 1972, the sample of children scored 7 points higher on the previous version of the WISC that had been standardized in 1947. Combining these kinds of data for several IQ tests, a one-standard-deviation increase in mean intelligence in the US is apparent over several decades (Figure 3). The

cohort effect is gradual and almost linear since World War II, but in terms of a population-wide change in intelligence manifested in one generation of Americans, it is a large effect. It is especially thought-provoking that the size of the cohort effect is not much different than the widely publicized black-white IQ difference in the US. That is, more recently born children exceed the raw intelligence of their own parents at a comparable age by almost the same average amount as Americans of European ancestry exceed Americans of African ancestry, especially on more recent tests of mental ability.

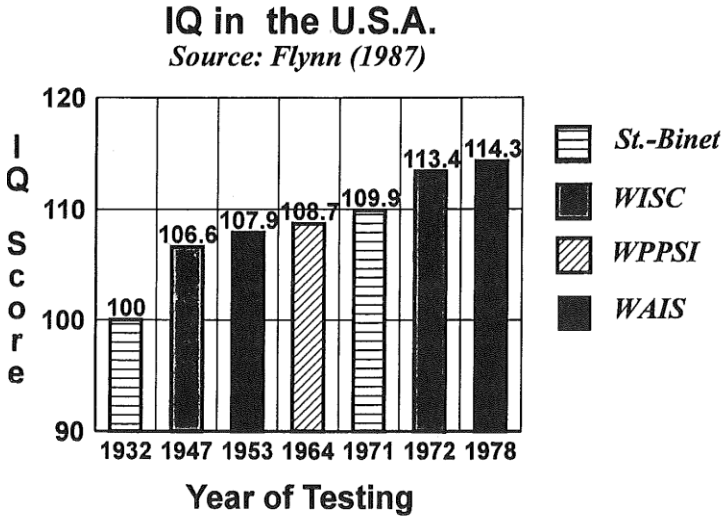

Figure 3. Mean IQ scores of standardization samples for four IQ tests given to Americans of European ancestry in various years. In each case two or more of the tests were taken by the same people in the same year, and averages were expressed in terms of the base score of 100 on the Stanford-Binet in 1932. Abbreviations: St.-Binet, Stanford-Binet; WISC, Wechsler Intelligence Scale for Children; WAIS, Wechsler Adult Intelligence Scale; WPPSI, Wechsler Preschool and Primary Scale of Intelligence. Based on data in Table 7 of Flynn (1987).

Herrnstein and Murray mention the cohort effect in their discussion of group differences, but they lightly dismiss it as a mere improvement in "test taking" skills or betterment of the living conditions of the disadvantaged. They muse that "one does not get the impression that the top of the IQ distribution is filled with more subtle, insightful, or powerful intellects than it was in our grandparents' day" (p. 308). Thus, faced with weighty evidence against their thesis, they are willing to dismiss the cohort effect with counter-arguments that negate some of their own fundamental claims. If the cohort effect represents improvement by only the bottom half of the "bell curve" rather than the entire population, then their earlier claim that increasing IQ is extraordinarily difficult loses credibility. After all, if the population mean increases by 15 points but the top part of the distribution does not increase, the lower scores must have increased by much more than 15 points. Herrnstein and Murray maintain assiduously in the first half of their book that IQ tests as we know them are very good measures of general intelligence. Yet the cohort effect causes them to revert to subjective impressions about their grandparents who must have been children when the IQ test was still embryonic in the mind of Alfred Binet. Actual experience in the US with the earliest administrations of IQ tests revealed that many men at the apex of American society were none too heavy under the helmet. The December 29, 1915 issue of the *Chicago Herald* trumpeted to its public: "Hear how Binet-Simon method classed mayor and other officials as morons" (Chase, 1977, p. 241). As for outstanding intellects, without doubt they are products of their times and countries, but their achievements do not provide a valid measure of the intelligence of their lesser countrymen, who all too often failed to recognize genius in their midst, partly because of the prevailing political and social definition of genius (Weisberg, 1986). Formal IQ tests were intended to supplant subjective impression and common prejudice with carefully constructed instruments administered in a controlled conditions. For Herrnstein and Murray to tiptoe around the cohort effect by suggesting that IQ tests do not *really* measure *genuine* intelligence but something more superficial and transitory is a negation of a fundamental part of the thesis of *The Bell Curve.*

The cohort effect poses an even greater challenge to the raison d'être of *The Bell Curve.* Herrnstein and Murray raise the alarm about several worrisome social trends in the US and argue that inadequate intelligence is the root cause of most social problems. They present striking graphs of social statistics over several decades that reveal a

dramatic deterioration in American society, especially from 1960 to 1990. Over this period, we are told that the marriage rate has declined while the divorce rate has increased from 7% to 20% and "illegitimate" births have increased from 5% to 30%, welfare caseloads have risen from 1.5% to 7%, and the rate of violent crimes is now five times higher than three decades ago. Nevertheless, the raw intelligence of American youth has apparently increased a substantial amount over this same interval. A national decline in intelligence could not possibly be the basis for these negative social trends.

The primary evidence Herrnstein and Murray offer for the important influence of individual intelligence in American society is a series of positive correlations between IQ and variables such as success in school, work, and social life. Correlations are notoriously poor guides to the direction of causal influences even when multiple regression methods are used, and this kind of information cannot distinguish between socioeconomic causes of low or high intelligence and consequences that flow from differences in intelligence at any one time. Comparisons of groups of people living in changed environments, on the other hand, can reveal the direction of causation. Adoption from a low SES home into a high SES home is clearly a change in environment that precedes and causes the change in childhood IQ, presuming the theorist will admit that even the brightest infants lack the power to choose their parents. Likewise, the cohort effect implicates nationwide environmental change as the cause of enhanced childhood intelligence. This enhanced intelligence may then consolidate and build on past achievements as the youth mature and become productive, influential members of society.

In my opinion, *The Bell Curve* from beginning to end suffers from a lack of intellectual rigor and a rather cavalier use of data mustered from here and there to bolster an obvious political agenda. The authors are worried about the growing gap between the rich and the poor in the US and the apparent disintegration of American society, and they offer some suggestions for policies that make sense from the perspective of the psychology of animal learning, Herrnstein's specialty. When they invoke genetic explanations for class and racial differences in educational and occupational achievement, however, they enter a realm where their incompetence is painfully evident (Kamin, 1995). Herrnstein, Murray, and their publicists still do not understand that genetic phenomena cannot be the root causes of short-term social trends. These socioeconomic trends are rooted in the political and economic system that prevails in the US. Moral decay does not arise from a sudden, inexplicable epidemic of genetic mutations. The obsession of so many social scientists and journalists with genetic victim blaming serves to divert attention from the real causes and cures of social ills. *The Bell Curve* itself and the attention lavished on it are symptoms of social malaise in the US.

As a final example of this malaise manifest in academic circles, consider the attempt by Herrnstein and Murray to deny the accusations of fraud against British psychologist Cyril Burt, who is widely recognized as the author of fictitious data and articles purporting to show high heritability of IQ (Hearnshaw, 1979). In a box on page 12, Herrnstein and Murray cite books by Joynson and Fletcher claiming to show that accusations against Burt are groundless. What Herrnstein and Murray fail to mention is an authoritative, peer reviewed critique by Samelson (1992) of these books that finds the accusations against Burt well substantiated and the work of his defenders shoddy and one-sided. Samelson concludes:

> What does this whole affair tell us about so-called science and scientists, insiders and outsiders, power structures and establishment climates in a profession, about "experts" whose beliefs flipflop from one side to the other, about presumably responsible editors, and finally about "quality control"? Beyond some pious words about them, we do not appear to have made much progress on these issues. (p. 231)

In this respect *The Bell Curve* is a step backward rather than a benchmark of progress in the nature-nurture debate.

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