Chapter 21: Genes, IQ Scores, and Social Status: II. Genetic Epidemiology

TO DO:

Update ref for McArthur (?)

Chambers Correlation

Introduction

In this chapter, we will initially examine the genetic epidemiology of IQ scores, the definition of the social status phenotype, and the genetic epidemiology of social status. The most important section follows these three topics—it treats the relationship between IQ scores and social status variables.

Genes and IQ Scores: Genetic Epidemiology

Kinship Correlations from Older Studies

Table 21.1 presents a portion of the world literature on kinship correlations for IQ that was compiled by Thomas Bouchard and Matt McGue in 1981. Studies appearing after that publication will be discussed later. For the moment, examine the table, the number of different studies that have been done and the average correlations for relatives with various degrees of genetic and environmental relationships.

[Insert Table 21.1 about here]

First examine the correlations for genetic relatives who have not been raised in the same household. The pooled correlation for MZ twins raised apart is .72 and the correlations for first degree relatives (sibs and parent-offspring) are slightly above .20. This gives strong evidence for a genetic influence on IQ. Otherwise, why would relatives who have not shared any environmental similarity correlate greater than 0.0?

Next examine the correlations for kinships of different degrees of genetic relationship but who have been exposed to the same family environment. MZ twins raised together correlate .86; DZ twins, .60; sibs, .47; parents and offspring, .42 and half-sibs, .31. Notice how the correlations fall off according to genetic relatedness. Another salient point about these correlations comes from a comparison of them with those for genetic relatives raised apart. For MZ twins the correlations are: apart = .72, together = .86; for sibs, apart = .24, together = .47; and for parent-offspring, apart = .22, together = .42. Clearly living (or being raised) in the same family increases the similarity among relatives. This is a key point that differentiates the genetics of cognitive abilities from those of personality—family environment does not make relatives very similar for personality traits but it does make relatives similar for intelligence.

Examining the correlations for genetically unrelated individuals who live in the same family reinforces this point. The correlation for adoptive parents and offspring is .19 and the correlation for adoptive siblings is .34. Clearly, this similarity must be due to the effects of family environment.

Heritability can be computed is several ways from these data. The correlation for MZ twins raised apart gives a direct estimate of around .70. Using twins raised together, one gets an estimate of .52. From data on parent-offspring and siblings raised apart, the estimate is slightly above .40. Once again, we find that heritability falls into the moderate range. It is neither large (i.e., .80 or greater) or small (i.e., .20 or smaller).

The correlation for genetically unrelated individuals living in the same families gives a direct estimate of the family environment effect on intelligence (i.e., the quantity ηe^2). Because these correlations lie between .19 and .34, we can conclude that somewhere between 20% and 35% of the observed individual differences in IQ are attributable to the family environment.

The idiosyncratic environment (i.e., all those environmental factors unique to an individual and not shared by relatives) comprises the rest of the pie. This can be estimated as 1.0 less the correlation for MZ twins raised together or 1.0 - .86 = .14. Hence, around 15% of the observed individual differences in IQ scores are attributable to the idiosyncratic environment.

Kinship Correlations for New Studies

Do the correlations from studies published since 1981agree with these earlier studies? Several major (and many minor) studies have appeared since that time and the results are generally—although not always—consistent. The first of these studies comes from the Minnesota study of twins raised apart (Bouchard, Lykken, McGue, M., Segal, & Tellegen, 1990), to date, the largest series in the world literature of twins who have been raised in different households. For the five different measures of IQ scores, the correlations for 42 to 48 pairs of MZ twins raised apart ranged from .64 (verbal scores on the WAIS) to .78 (first principal component of special mental abilities). The second was data from a smaller series of Swedish twins raised apart where the MZA correlation was

.78 (Pedersen et al., 1992). These correlations fit well within the pooled estimate of .72 previously presented in Table 21.1.

The other major works include adoption studies from Denmark (Teasdale & Owen, 1984) and Colorado (Plomin et al., 1997), and follow-ups of an early adoption series from Minnesota (Scarr, Weinberg, & Waldman, 1993; Weinberg, Scarr & Waldman, 1992) and from Texas (Loehlin, 1994, 1997). A major new finding emerged from these data—the IQ correlation for nongenetic relatives raised in the same family depends on the ages of the relatives. All the adoption correlations in Table 21.1 involved *young children*. These correlations, along with those from the more recent studies, suggest that there is an important shared environment influence on IQ in younger children. When these young children become older and leave the home, this family environmental influence seems to dissipate. The pooled correlation for *adult* adoptive relatives is -.01 (Bouchard, 1999; McGue et al., 1993). In short, when nongenetic relatives become adults, they do not seem to resemble each other on IQ scores any more than two randomly selected adults from the general population.

To summarize, IQ scores are highly familial in the sense that they show strong family resemblance. Like personality, genes are an important source for this familial resemblance, and heritability of IQ scores is in the moderate range. Unlike personality, where genes are the major source of familial similarity, shared family environment is important for the resemblance among relatives. This common environmental influence appears important for young children but seems to diminish in adults. The salient features of the family environment responsible for this effect are unknown. **[MENTION**

DISCREPANCY OF ADOPTION WITH TWIN DATA—why do twin data show c2?]

The Flynn Effect: A shared family environment influence on IQ

The advent of the United States into World War I was accompanied by the first group administered IQ tests—the Army Alpha test for recruits with English language skills and the Army Beta tests for those recruits (mostly recent immigrants) with linguistic skills in languages other than English. At the time of induction of the National Guard into the Armed Forces shortly preceding Pearl Harbor, it was noticed that the mean score of recruits on these tests greatly exceeded those of the inductees in WWI (Tuddenham, 1948). At the same time, psychologists like Cattell (1951) noted that the mean IQ scores of the general population were rising despite the demographic "dysgenic" trends that will be discussed later in this chapter.

Such data were of largely academic importance until a series of publications by Flynn (1984, 1987) gave convincing documentation that IQ scores in Western industrialized societies were rising over time. Small European countries such as the Netherlands and Denmark have universal conscription among males. Except for gross physical and mental anomalies, all males in these countries are required to register for the armed forces and to take a series of standardized tests. Because the standardized tests included a measure of IQ used year after year, the data effectively constituted a whole population (i.e., males) who were administered the same test year after year. Flynn's data demonstrated that the mean scores on this test increased year after year. Thus, the Flynn effect was born—IQ scores are increasing over time and appear to be doing so in the entire industrialized world.

The current controversy over the Flynn effect does not involve its existence—with few exceptions, everyone acknowledges that raw IQ scores are increasing over time. The big debate is over *why* scores are increasing. Many, including Flynn (1998) himself, suspect that there has been no real change in the anatomical and physiological substrates of IQ. Instead, they argue that variables including increasing familiarity with test taking have driven the secular trend. This may indeed be true but it poses a strong challenge to the interpretation of the genetic data on IQ—to what extent does the similarity among relatives measure real similarity in IQ as opposed to sophistication in test-taking?

Whatever the ultimate causes of the Flynn effect, the rise in IQ scores has been so strong that it cannot be plausibly caused by any known genetic mechanism of evolution. Population size is much too large for genetic drift to influence the change. Neither have any reasonable data over the past 50 years suggested strong increased fitness for high IQ scores. In fact, much of the data suggested that low IQ is associated with increased fitness. Hence, almost everyone believes that the source of the Flynn effect is in the common family environment for siblings[1]. Just what aspects of the common environment are responsible for the effect? Nutrition, test-taking acumen, and schooling are likely suspects but to date there is no convincing data to pick out the real culprit(s) from the innocents (Neisser, 1998).

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[1] The reason why the data on adult adoptive siblings have not shown the effect may be that all samples are severely restricted in range for the age of the adoptees. It would probably take a series of adult adoptees ranging from age 20 to 80 to demonstrate the Flynn effect.

Genes, *g*, and Multiple Intelligences

In the previous chapter, we discussed the controversy about intelligence as a single construct as opposed to the notion of multiple intelligences. Does the genetic data shed any light on this problem? The answer is a qualified "yes." The data on genetics give insight into the problem, but given the large number of twin and adoption studies on IQ, relatively few have taken the extra time and effort to perform the difficult analyses that could help answer this question.

The types of data necessary for these analyses consist of the cross-twin, cross-trait correlations. A cross-twin, cross-trait correlation is best understood by taking a simple example. Under ordinary circumstances, we could compute the correlation between, say, the vocabulary score of twin 1 and the vocabulary score of twin 2. The result would be a quantitative index of the extent to which the twins resemble each other in their vocabulary scores. This is a cross-twin, *same*-trait correlation. A cross-twin, cross-trait correlation is computed as the correlation between one trait in twin 1 and a *different* trait in twin 2. An example would be the correlation between twin 1's vocabulary score and twin 2's arithmetic score.

In real life, researchers compute two cross-twin, cross-trait correlations, one for MZ twins and the other for DZ twins. Comparison of the MZ with the DZ correlation informs us of the genetic influence on the reasons behind the phenotypic correlation between vocabulary and arithmetic. To phrase the problem slightly differently, we could first ask the question of why do individuals who score high on vocabulary also tend to score high on arithmetic. Some of this relationship may be due to genes and some of it to environment. When the MZ cross-twin, cross-trait correlation is higher than the DZ cross-twin, cross trait correlation, then genes must be an important reason for the correlation. Sophisticated statistical analysis—beyond the scope of this book—may be used to arrive at an actual quantitative measure of how important the genes are for the correlation between vocabulary and arithmetic.

The data from several twin and adoption projects have given a very consistent answer to this question—there is a genetic *g*. In the previous discussion of intelligence and multiple intelligences, we found that scores on any one mental ability tests predict scores on any other mental ability. We also learned that because of this, *g* is a legitimate concept—a single number that captures as much variability as possible among the diverse measures of cognitive talent. The data show that these two statements describing the *phenotype* also apply to the *genotype*. Multivariate genetic analysis has continually shown that hypothetical genetic values for any one cognitive ability predict those genetic values for any other mental trait. There is also a genetic *g*.

Table 21.2 illustrates these two points using published twin data on the scales of the WAIS. The numbers on the diagonal give the percentage of phenotypic variance in a WAIS scale attributable to genetic individual differences (i.e., the heritabilities expressed as a percent). The numbers above the diagonal give the percentage of the phenotypic correlation between two different scales that is due to genotypic factors. For example, the number 65 for the Information and Comprehension scales means that 65% of the phenotypic correlation between these two scales is attributable to genetic factors. (The nature of these genetic factors, of course, cannot be determined by these figures.) If you visually inspect the 55 different estimates above the diagonal, you will find that only three of them are lower than 50 (i.e., half of the phenotypic correlation). This means that genes are the major source behind all those reasons why one cognitive ability correlates with another mental talent.

[Insert Table 21.2 about here]

The numbers below the diagonal are genetic correlations. They are estimates of the extent to which hypothetical genetic values on WAIS scale predict genotypic values on another WAIS scale. Inspection of these numbers also shows overall strong relationships among most of the WAIS scales—the genes influencing scores on one trait also effect scores on other traits. Statistically, these results point to a genetic *g*, although the biochemical nature of the genetic *g* is unknown.

Genes and the Development of IQ

Suppose that I have two beakers, both of which contain two ounces of water. I pour the first beaker into a tall, thin container and the second beaker into a short, squat container. Which of the two containers—the tall, thin one or the short, squat one—has more water? To you and I, the answer is simple. Both have the same amount of water, exactly two ounces. But young children more often than not identify the tall, thin container as having more water than the short, squat container.

Reflect on this for a minute. You are an adult and are fully aware of all the symbolic processing and abstract reasoning that goes into giving a correct answer to this question. But as young children, both you and I were quite likely to have arrived at an erroneous conclusion. Our genes and our prenatal environment have not changed in the interim, but obviously our intelligence has. The general problem that this example addresses is the following—is intelligence an "innate" quality or does it develop over time?

Both common sense and all the research data suggest that the degree of symbolic encoding, processing, and reasoning increases over time. Four-year olds can solve more difficult problems than two-year olds, and eight-year olds can solve more difficult problems than four-year olds. To what extent is this difference due to accumulated experience with the real world and to what extent is it due to developmental and maturational effects of the human nervous system? At this time, there is not enough empirical data to answer this question. But from a genetic perspective one point is clear—humans are not just "born" with intelligence. Intelligence develops over time, although the reasons behind this development are obscure. In short, there really is no such thing as "innate intelligence." Intelligence is lemonade.

The problem outlined above focuses on differences in *mean* levels of intelligence over time. A completely different problem consists of the *consistency of individual differences* over time. That is, irrespective of the increase in intelligence from years two to four, why do children who score high at age two also tend to score high at age four? Here, the emerging data suggest that genes contribute to the stability of individual differences in intelligence over time.

The types of data are analogous to the cross-twin, cross-trait correlations outlined above, but instead consist of cross-twin, cross-time correlations. To what extent does the IQ score of twin 1 at time 1 predict the IQ score of twin 2 and time 2? If these correlations are higher for MZ than DZ twins, then we have good evidence that genes contribute to the stability of individual differences in IQ over time. Three major empirical studies that have data related this issue—the Louisville Twin Project (Wilson, 1983, 1986), the Colorado Adoption Project (Plomin & DeFries, 1985; Plomin, DeFries & Fulker, 1988; DeFries, Plomin & Fulker, 1994), and the McArthur Longitudinal Twin Project (Chambers, 1999)—and their results are consistent. Genes are major contributors to the stability of IQ over time.

Table 21.3 presents data from the McArthur Twin Project that measured IQ from 14 months through seven years of age[2]. Figures above the diagonal estimate the percentage of a phenotypic correlation between two time points attributable to the shared, family environment while the numbers below the diagonal estimate the contribution of the genes to this correlation. For example, the phenotypic correlation between IQ measured at 14 months and IQ measured at 20 months is .**XX**. Forty-one percent of this correlation appears due to the common family environment and 52% is attributable to genetic sources. In total, 93% of the correlation is due to familial factors—shared genes and shared environment.

[Insert Table 21.3 about here]

There is an intriguing pattern to these correlations. Genes contribute to the stability of IQ scores at all ages. The common environment, on the other hand, may have age-dependent effects on IQ stability. Examine the figures for the row involving 14-month IQ. There is an important contribution to stability at 20 months (41%) that diminished slightly at 24 months but then drops close to zero at 3, 4 and 7 years. The row for stability starting at 20 months shows a similar pattern. At later ages, common environment seems to contribute importantly to IQ stability. Hence, the common environment does not appear to be a strong reason for IQ stability from infancy to early childhood, although it does seem to contribute to stability for adjacent testings in infancy and to stability during early childhood. Genes, on the other hand, contribute to stability at all ages.

Surprisingly, there are no modern genetic studies of IQ stability in the transition from adolescence to adulthood and during the early and middle adult years. Research in later adult years suggests that the stability of cognitive talent in the elderly is due mostly to genes (Plomin et al., 1994). There is also evidence that genes contribute to some patterning of decline in cognitive ability in older adults (Swan et al., 1990, 1992).

In summary then, genes are important contributors to IQ stability in infancy and early childhood and are the major source of stability in later life.

Social Status: The Phenotype

The concept of social status (AKA socioeconomic status) has had a long history in the social sciences, particularly sociology and psychology. It is a composite variable that is the sum of three separate phenotypes—education, occupational status, and income. Education is typically measured as the highest educational level completed and not simply the number of years spent in school. That is, a college graduate with a bachelor's degree is awarded 16 years of education even though the person may have spent five years in college to complete the degree.

Occupational status consists of an arbitrary—but well agreed on—scale of job prestige. If one takes a large group of occupations and has people rank them on their

[2] The McArthur project is still ongoing and the twins are being followed up.

prominence, then one finds a strong amount of agreement. An electrician is more prestigious than a full-time burger-flipper, an electrical engineer has more status than an electrician, and a neurosurgeon has higher prominence than an electrical engineer. Low status occupations are generally unskilled or semi-skilled labor. Next on the hierarchy lies skilled labor such as shop attendants and the trades (plumber, carpenter, electrician) followed by low and then middle-level management positions. At the top are medical doctors, lawyers, business-owners, and high-level managers.

The third variable composing social status deals with money. Economists distinguish three facets of monetary differences between families—earnings, income, and wealth. Earnings are the amount of money that one makes from a job or profession, usually measured over the course of a year or so to avoid seasonal phenomena that might influence weekly or monthly earnings. Income includes earnings but adds to them all other sources of money that one regularly receives such as investment dividends. Wealth includes income but adds to it all the accrued monetary resources like home equity and capital investments. The behavioral genetics literature almost always deals with earnings and/or income[3]. There appears to be no twin or adoption data related directly to wealth.

Let us call this version of social status the "traditional" measure. There are indeed critics of the construct of social status and others who extend the construct to include psychological variables like orientation to achievement and. Once again—just like the IQ score—the majority of the literature deals with the traditional three measures

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[3] Technically, the natural logarithm of income is used in data analysis to make the distribution more normal. I will refer only to income with the implicit assumption that ln(income) is the actual variable used in data analysis.

of social status. Hence, we are stuck with this definition just as we were stuck with the definition of an IQ score.

Social Status: Genetic Epidemiology

In this section, let us review the twin and adoption data on education, occupational status, and income. Table 21.4 presents the results of the major recent twin studies on the issue[4]. To interpret these data, focus on the comparison of MZ and DZ correlations within a study and within a phenotype. Because the studies come from different countries and some have data from different generations, it in unwise to compare the correlations of one study with another.

[Insert Table 21.4 about here]

There are more data on educational level than on occupational status and income combined. In all five studies, the MZ correlation is significant higher than the DZ correlation, and like most behavioral phenotypes, heritability is in the moderate range. Even though the data come from different countries, each of the five twin studies report a significant effect for shared, family environment, effect size ranging between one-quarter and one-half of the phenotypic variance[5]. The genetics of education, however, are not as simple as calculating parameter estimates. Using virtually the whole population of twins in Norway, Heath et al. (1985) demonstrated that both heritability and common

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[4] A few studies contain relevant data but are omitted from this table because they did not present twin correlations or results that permitted the estimation of twin correlations.

[5] As with intelligence, interpretation of the common environmental influence is confounded by the high spousal correlation for educational levels. The difficulty is not the *size* of the marital correlation. One can measure that and placed it into a mathematical model. The problem is the *source* of the correlation. The mathematical consequences for *mate attraction* (people are attracted to mates with similar amounts of education) are different from those on *mate propinquity* (people like college students associate largely with

environment were influenced by year of birth and sex. Similar influences were absent in a very large sample of Australian twins (Baker et al., 1996). These results suggest that the cultural background must always be considered in the interpretation of genetic data.

Interestingly, there are few twin data on occupational status. Still, the one study from Table 21.4 and the results of other studies that did not report twin correlations (Lichtenstein et al., 1997) suggest moderate heritability for this phenotype. Finally, the three twin studies with data on income also suggest a genetic effect.

There are few adoption data on social status. Only one study—and one with very modest sample sizes at that—examined the similarity between adopted siblings and genetically related siblings raised apart. The correlations are presented in Table 21.5 (Study 1) along with the results of a second adoption study (Scarr & Weinberg, 1994)[6] and a third study (Rowe, Vesterdal & Rogers , 1998) that compared the similarity of full sibs to half siblings raised in the same family.

[Insert Table 21.5 about here]

All studies suggest heritability for education, and study 3 replicates the genetic effect from the twin data on income. The results on occupational status are confusing [**REWRITE WHEN YOU CAN GET THE TEASDALE PAPER**]. There is suggestive evidence for a shared environment influence on education because adoptive siblings resemble each other more than chance. This common environment influence is also by examining the correlation between the adoptive family background and the

other college students). The precise blend of propinquity and attraction that generated the marital correlations for education is unknown.

[6] The offspring in this study, Scarr and Weinberg (1994), ranged in age from 22 to 30. Hence, many of them have not completed their education or career paths.

educational level of the adoptee. This correlation is significant in both of the adoption studies.

Genes, IQ Scores, and Social Status: The Question of "How"

For those readers who have taken the introductory chapter to heart, the genetic epidemiology of IQ scores, education, occupational status, and income should be boring. In that chapter we learned that there is moderate heritability for almost all behavioral phenotypes, so IQ and social status are more likely to follow this rule than be exceptions to it. We also learned that behavioral genetic research is more interested in the question of "how" genes influence phenotypes than in estimating heritability. Data from the past hundred years have been unequivocal in demonstrating that people with above-average IQ scores tend to achieve higher levels of education, obtain more prestigious jobs, and make more money than those with lower IQ scores (see Hunt, 1995, and Neisser et al., 1996, for general reviews). How then do genes for IQ scores influence social status?

Two Extreme Views

Let us start this discussion by contrasting two radically different views of the situation, both of them deliberately set up as "straw people" herein in order to help the student understand the issues. The first straw person starts with Herrnstein and Murray's (1994) view of IQ and social structure. IQ, according to them, is quite heritable and a powerful, independent predictor of education, occupational status, income and a host of other variables such as job performance, welfare, and crime. Over the past century, society has been moving more and more towards a *meritocracy*, a social system in which movement up and down the ladder of social status depends more on an individual's own talent and abilities than the family in which the person was born[7]. And the talent and ability that matters most to social movement is IQ. Both the educational system and the labor marketplace are becoming increasingly more efficient in selecting for IQ. It no longer takes an average level of IQ to become a physician or to move up the corporate staircase into a vice presidency.

Because genes influence IQ, because IQ has a causal influence on eventual social status, and because society is becoming ever more efficient in selecting for IQ, society is becoming increasingly more stratified on the basis of the genes for IQ. Because families at the bottom of this heap have more children than those at the top, we will gradually evolve from a largely middle class society into one resembling a capitalistic, third world culture. A few genetically talented and/or wealthy families will form a quasi-aristocracy at the top; the large, impoverished majority at the bottom will have declining advantage; and the broad-based middle class will almost disappear. To recognize that this is an oversimplification of Herrnstein and Murray's (1994) position, I will call this the Murrnstein hypothesis.

To complete the straw man at the opposite end of the spectrum, consider the work of Lewontin, Rose, and Kamin (1984). These critics of behavioral genetics argue that IQ is a very narrowly defined phenotype that has little direct relevance for social status and that all the genetic data presented in this chapter are seriously flawed. At the very least, they are agnostics. If the definition of intelligence could be expanded, if we could reliably and validly measure this expanded construct (or constructs), and if new genetic

[7] The opposite of a meritocracy is a *heritocracy* and is taken to an extreme in feudal society in which social status (wealthy mobility versus impoverished serf) is mostly determined by the status of one's parents.

data could be gathered that overcome the methodological problems, then—in theory at least—the results might actually validate the Murrnstein hypothesis. Instead, I will develop a new straw person and term it the Rosemintin hypothesis based on imagined conversations with these critics in which they reveal what they actually think is going on and then taking their ideas to an extreme.

According to Rosemintin, society has not moved very far away from medieval heritocracies in which social status is determined mainly by parental status. Those families that accrue a sufficient amount of wealth will move into desirable neighborhoods where their children attend upscale schools. Better education in these schools along with the advantage of encyclopedias and computers at home increases IQ scores. The children will also associate with wealthy peers and role models who stress the importance of education and well-paying occupations in accumulating wealth. The children are encouraged not just to attend college but to attend elite colleges where they develop networks of social contacts that "grease the wheels" for them to move into better jobs. (After all, their parent can afford a private college.) In short, parental advantage "jump starts" their social status and when they themselves become part of the wealthy, they can "jump start" their own children's careers.

Both the Murrnstein and Rosemintin hypotheses have the same view of social status and both accept the fact that IQ scores are correlated with social status. What they differ in is *how* this correlation comes about. Murrnstein suggests that genes for IQ are a major causal factor. IQ scores are highly heritable and IQ drives the social status train. True, some individuals will obtain great wealth by inheriting fortunes, but for each trust-

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Naturally, meritocracy and heritocracy are not categories but opposite poles of a continuum on which funder there are a hundred people who obtain their social status from merit. Rosemintin, on the other hand, views the correlation between IQ scores and social status as noncausal and mediated by parental advantage. Family wealth and social status perpetuates itself. Economic advantage leads to good schooling and higher IQ scores. Impoverishment leads to a deprived education and lower IQ scores. True, there are rags-to-riches stories, but these are few and far between compared to the majority of people who start out life with different degrees of advantage.

Sadly, it is now time to dispel both the Murrnstein and Rosemintin positions as myths by examining data. The "sadly" modifier comes about because within academia there are still small minorities—albeit very vocal ones that receive more attention in the popular press than among scholars in the field—who come close to these extreme positions.

The biggest argument against the Murrnstein hypothesis comes from quantitative considerations of the very data that adherents cite to support it. Consider the mathematical implications of the Murrnstein model depicted in Figure 21.1. Individual differences in the genotype for IQ (G_{IQ} in the figure) contribute to phenotypic individual differences in IQ (P_{IQ}). These phenotypic IQ differences in turn have a direct causal impact on a person's phenotypic social status (P_{SS}).

[Insert Figure 21.1 about here]

The quantity *h* in Figure 21.1 gives the causal effect of genetic individual differences on phenotypic individual differences in IQ. This quantity is simply the square root of the heritability for IQ. The quantity *a* marking the arrow from P_{IQ} to P_{SS} measures

different societies can be ranked.

the strength to which IQ causes social status. From this model, the extent to which genes for IQ result in social stratification is given by the quantity a^2h^2—the square of the casual relationship between IQ and social status times the heritability for IQ. Now let us plug numbers into this equation and view the results.

One can obtain an upper bound estimate of a^2h^2 by substituting the *correlation* between IQ and social status for the quantity *a*. This is an upper bound estimate because the correlation coefficient is the sum of two effects—the actual causal effect of IQ on social status plus all the indirect, but noncausal effects that influence the correlation. By accepting the larger estimates of heritability, we can then calculate the *maximal* value of the extent to which IQ genes result in social stratification. The largest estimate of heritability for IQ in the literature comes from the correlation for MZ twins raised apart—it is about .70. The correlation between IQ and social status depends upon the individual variable for social status. It is largest for education and smallest for income. Table 21.6 provides estimates of these correlations from five large studies of the general US population.

[Insert Table 21.6 about here]

The average correlation between IQ and education in Table 21.6 is around .55. Hence, the maximal estimate of a^2h^2 is $.55^2(.70) = .21$. This figure means that genetic differences for IQ account for—at a maximum—21% of the phenotypic variance in education. The average correlation for IQ and occupational status is about .43 giving the estimate of a^2h^2 as $.43^2(.70) = .13$. Finally, the average correlation between IQ and income is .31 giving a^2h^2 is $.31^2(.70) = .07$. These estimates are not trivial when compared to the effect sizes in most social science research areas, but they are certainly not huge in any absolute sense. I leave it to the reader to enter his/her own preferred values for heritability and the correlations between IQ and social status and come to his/her own conclusions about whether we are about to develop something close to a "caste system" (Herrnstein and Murray, 1994) based on the genetics of IQ.

Mathematical predictions from the Rosemintin hypothesis are presented in Figure 21.2. Parental social status (Parent_{SS}) influences offspring IQ (P_{IQ}) via the path marked *b*. Parental social status also directly influences offspring social status (P_{SS}) though path *c*. According to this model, the predicted correlation between an individual's own IQ and social status should be the product of these two quantities or *bc*. Once again, we can obtain the maximal estimate of this correlation by substituting the observed correlation between parental social status and offspring IQ for *b* and the observed correlation between parental and offspring social status for *c*. We can then compare this maximal estimate to the observed correlation between an individual's IQ and social status to examine how well the model explains the data.

[Insert Figure 21.2 about here]

Again, the estimates of *b* and *c* depend upon the specific social status variable. Mulligan (1999) as cited by Bowles & Gintis (2001) has reviewed these data and arrived at average estimates of *c* ranging from .29 (parental education with offspring education) to .43 (parental income with offspring income). Estimates of *c* are a bit harder to obtain because many studies do not subdivide parental social status into education, occupational status, and income in computing the correlation. A review by White (1982) places the correlation in the .30 to .40 range. Let us accept the highest value, .40. Hence, the predicted value for IQ and any social status variable should range between .29(.40) = .12

and .43(.40) = .17. Compare this range with the observed correlations given in Table 21.6. The observed correlations are always *higher*—often substantially higher—than the ones predicted by the Rosemintin model.

That there is something fundamentally wrong with this model can been seen by recognizing that the product of two fractions must always be less than either of the two fractions themselves. Since *b* and *c* are fractions, the product *bc* must always be less than *b* and less than *c*. To say this in English, the Rosemintin model implies that the correlation between IQ and social status (*bc*) must *always* be less than the correlation between parental social status and offspring IQ (*b*). The empirical evidence over the past century says just the opposite—an individual's IQ is a better predictor of his/her eventual social status that the social status of the family that s/he was raised in. There must be additional factors responsible for the correlation between IQ and social status other than family advantage.

To the bleary eyed student dazed by the "correlations between this, that, and the other thing" tone of this prose, I offer a quick—but very important—synopsis. The simple-minded notion that "(a) genes influence IQ and (b) IQ influences social status, so therefore (c) genes for IQ strongly stratify society" is wrong. Social stratification by genes for IQ is *not zero*, but the effect is *not large* either. To provide an analogy, we all agree that rain causes slippery roads and slippery roads cause accidents. But this does not imply that every person—or even the majority of people—driving on a rainy day will have an automobile accident.

Similarly, the simple-minded notion that "(a) parental social status influences offspring IQ, and (b) parental social status also influences offspring's eventual social status, so therefore (c) the correlation between IQ and social status is due to parental social status" is equally incorrect. *Some* of the correlation between IQ and social status may be due to parental social status, but *not all* of the correlation is due to it. Consider another analogy—rain causes the roads to be slippery and rain causes automobile accidents. But obviously rain is not *the only* reason why slippery roads are correlated with accidents. The day could be bright and shiny, but a patch of ice, oil, or even gravel could result in a fender-bender.

If you are beginning to think that the relationship between genes, IQ scores, and social status is complicated, then you are on the right direction. Human behavior is complicated and multifactorial, so phenotypes like IQ and social status are probably the result of a convoluted network of causal factors. Simple explanations of human behavior such as the Murrnstein and Rosemintin views, are usually simple-minded too.

A Complete View: Emerging patterns to a puzzle.

The necessary data to gain a complete view on genes, IQ scores, and social status would require genetically informative kinship correlations gathered with the types of designs used in large population surveys. Social status of the family of origin must be closely indexed, IQ should be measured during childhood and adolescence (and preferably again, later in life) and data on education, occupational status, and income should be gathered throughout the life span. There are simply no such data that meet all these requirements. Instead, we have only a few studies—almost all of which are cross-sectional and/or retrospective—that have analyzed how genes, IQ scores, and social status are related to one another. The situation is similar to that of working on a giant picture puzzle without the picture available and with little more than the edgework and a few small sections completed. It is still too early to guess what the whole picture look like—although there is no shortage of speculation on this issue. More time is needed to expand the small sections and piece some of them together before we firmly conclude about the subject composition of the whole picture. The following give results on how those few semi-completed sections of the puzzle appear right now.

The first section of the puzzle nearing completion is fairly clear and tells us *that there is more to the genetics of social class than simply the genes for IQ scores*. The little multivariate genetic data point to this conclusion (Lichtenstein et al., 1997; Rowe et al., 1999), but they are much too complicated to present here. Instead, we can view the topic through a simplified example. We have seen that both IQ and educational level are heritable, so let us hypothesize that the only reason for the heritability of education is the genetic effect for IQ. Specifically assume that the only reasons for heritability for education are (1) genes influence phenotypic IQ and (2) phenotypic IQ permits one to move further through the educational system. We are back to the model depicted above in Figure 21.1, but this time we can obtain a maximum estimate for the heritability for education. From the model, the heritability for education should be a^2h^2—the same figure for the genetic effect on social stratification for education we arrived at in discussing the Murrnstein model. Rounding off, that figure was .20, so we should expect that heritability for education should be no higher than .20.

Now compare this predicted number with the observed estimates from the twin data on education given in Table 21.4. Here, heritability can be estimated as $2(R_{mz} - R_{dz})$ or twice the difference between the MZ and DZ correlations. Most of these estimates are in the intermediate range of .40 to .50, well above the predicted value of .20. Something is the matter with this model. Exactly what is wrong?

There are too many possibilities to discuss each one in turn, but most scholars speculate that genes other than those for IQ also influence education. We all know that there are many different reasons why some people go far in the educational system while others drop out early. Some of the reasons include motivation, achievement drive, interest patterns, and personality. Examples abound. Someone with the intellectual capacity to succeed in medical school may have an intense interest in working outdoors with nature. She might forego postgraduate education to become a forest ranger. We all know of people who do well in the educational system (a prerequisite for entering college and graduate school) because they study all the time. We also know others with considerable intellectual talents who receive average grades because they do not study very much. If the genetics of these traits are similar to those of other behaviors—i.e., they have moderate heritability—and if these traits have a causal influence, however moderate, on eventual educational attainment, then there is more to the genetics of education than simply the genes for IQ.

A similar argument can be made for income. The estimate of a^2h^2 for income is .07, so the maximal heritability for income according to the model should be .07. The observed data from Table 21.4 give observed heritability estimates in the .40 to .50 range, similar to education but far greater than that predicted by the model. Once again, genes for personality, interests, and motivation may influence income independently of IQ. Our forest ranger is unlikely to have the same earnings as a physician. Religious clergy are usually well educated and have higher-than-average occupational status, but those types of vocations are seldom tickets to great wealth.

In summary, observed heritabilities for the social status variables of education, occupational status, and income are too large to be explained by only the genetic effects for IQ. Most researchers suspect that personality, interest patterns, and motivational factors influence social status variables, but like unconnected puzzle pieces, there have been no empirical data to join these single pieces to the larger section.

The second major section of the emerging puzzle suggests that *IQ works as an "indolent gatekeeper" for eventual social status*. That is, IQ permits the gates towards higher education to be open but does not provide a rigid system of entry (the *indolent* or *lazy* part of the gatekeeping). Think for a minute of the major factors that influence the majority of college admissions. They are high school grades, scores on standardized tests such as the ACT and SAT, and references. A rich family that generously contributes to the alumni fund does not hurt. Neither does unique individual achievements such as outstanding athletic or musical talent. But these exceptions are infrequent compared to the three criteria outlined above. Now reflect on what we have learned about the major correlates of IQ scores—they are school grades and scores on standardized achievement tests. Hence, to the extent that intelligence has any causal role on individual differences in school grades and standardized test scores, it is likely to also influence admissions to higher education.

But recall the indolence of the IQ gatekeeper. It *assists* but does not *guarantee* that the college gate will open. Variables such as studiousness, achievement-motivation, interests, etc. are also likely to have their own roles in the complicated causal decisions behind college admission. One thing is certain—few if any colleges require only an IQ score for admission. Freshmen are admitted on the basis of *scholastic achievement* in high school not directly on the basis of an IQ test score. We will review data on this after we examine the third emerging section of the puzzle.

The third puzzle section is that some social status variables operate as gatekeepers for other social status variables; particularly, education works as a major gatekeeper for occupational status. Once again, the gatekeeping role is more on the indolent and perfunctory side and not a rigid slave to rules carved in stone. The arguments for this are similar to those made above for intelligence. For example, there was no government edict that required Bill Gates to have a Ph.D. before founding and being the CEO of Microsoft. Instead of belaboring the issue, let us examine the pertinent data.

The data presented come from four longitudinal studies previously analyzed by Jencks et al. (1979)[8]. Longitudinal studies have the advantage that certain causal arrows can be eliminated. In a cross-sectional study of IQ and education in, say, 40 year olds, interpretation of the correlation between IQ and education in terms of causal paths is problematic. IQ may influence education; education may increase IQ; other variables may influence both IQ and education; and some combination of all three of these possibilities may be operating. Longitudinal data, while they cannot completely resolve the causal pathways, can eliminate some of the alternatives and give a clearer picture of what *might* be going on. Consider the correlation between IQ measured in the early high school years and educational level at age 40. Unless something is dramatically wrong with our understanding of the physics of space-time, educational level at 40 cannot be a

[8] See the legend to Table 20.6 for the references to these four data sets.

causal influence on adolescent IQ. Hence, the correlation between high school IQ and adult education probably reflects some combination of IQ causing education and of the influence of other variables like parental social status on both IQ and education.

The first temporal variable in these types of data is parental social status measured by father's educational level and occupational status. (Data on parental income were not available in all four of these studies.) The second is adolescent IQ score of the offspring, the third is educational level, the next is occupational status, and the final one is earnings or income. Through the statistical technique of multiple regression, we can predict any one variable from all those other variables that *precede* it in time[9]. Table 21.7 presents an example of this type of analysis where we try to predict IQ score from the two parental social status variables.

[Insert Table 21.7 about here]

In this table, the numbers are coefficients from the multiple regression that mathematically controls for one variable when examining the influence of the other variable[10]. They are analogous—but not identical—to correlations. Numbers close to 0 suggest that a variable has little predictability when controlling for the other variable. The larger the number, the more predictability. Consider the entry of .17 from the Veteran's study in which we predict adolescent/young adult IQ from father's occupational status. The control for father's education has the following interpretation. If we took all those fathers with, say, a high school education—no more and no less—then how well do differences in father's occupational status predict offspring IQ?

The answer is .17. Similarly, the values for father's education control for occupational status. For example, suppose we examined only those father's with a status of skilled workers such as plumbers, carpenters, and electricians. To what degree do educational differences among these fathers predict offspring IQ? The answer would be .15 in the Veteran's data, .16 in the PSID data, etc.

In interpreting the data in this and the subsequent tables, it is important to compare the numbers across a *row* and ask yourself the question, "which variables are the better predictors in this study?" For Table 21.7, father's occupational status is a better predictor in three of the four studies but not by very much. Most professional statisticians would examine the data would be struck by how similar these numbers are. Their basic conclusion would be that father's education and father's occupational status are equally good predictors of offspring IQ.

Table 21.8 presents the predictability of educational level from the two parental social status variables and a person's own IQ. A very clear picture emerges from all four studies. IQ is definitely the best predictor. The two parental social status variables still contribute significantly to prediction, but their influence is much smaller than IQ. These data illustrate a point made above in discussion of the Rosemintin hypothesis—a person's own IQ is a better predictor of their eventual social status that the social status of the family that raised him/her. These data illustrate IQ's role as a somewhat inattentive gatekeeper. High IQ is one of many different assets that can assist in movement up the

[9] Once again this technique is approximation. For example, it does not account for the causal influence of parents with a smart offspring who take on extra jobs so that their child can attend college. Here, child IQ plays some causal role in parental income.

[10] Technically, these quantities are called standardized partial regression coefficients.

educational ladder, but no one is standing at the base of the ladder demanding to see an IQ score before allowing a person to start climbing.

[Insert Table 21.8 about here]

Table 21.9 gives the most interesting data. Here we predict occupational status from the four variables that precede it. Once again, a very clear picture emerges from all four studies. The best predictor is *education*, not IQ or family background. In fact, father's social status in these studies ceases to be a significant predictor at all—the values are all close to 0. With an average value of .14, IQ has only modest predictive value. It is really education that best predicts differences in occupational prestige, illustrating the gatekeeping role for education on other aspects of social status.

[Insert Table 21.9 about here]

What has happened to IQ? If we place causal interpretations on these results, IQ would still be one of the causal factors for occupational status. It is just that its role is mainly *indirect*. The major causal pathway is that IQ influences education and then education influences occupational status; the direct effect of IQ on occupational status is small. To say the same thing in a different way, consider only those people whose highest educational attainment is a bachelor's degree. As a group, their average occupational status will exceed that of the general population. Among them, differences in IQ also predict occupational status—those with higher IQ scores will have slightly better jobs than those with lower scores—but the effect is not very large. The biggest impact of IQ in this group is to *help them get their sheepskins to begin with.*

The final data (Table 21.10) predicts income from all the variables that occur before it in time. Here the numbers do not show the clear pattern that the previous ones did. Family background—at least in terms of paternal education and occupational status—is not a significant predictor. IQ has some predictive power; its average value is .15 so it has as much of a residual effect on income as it did for occupational status. The effect of educational level varies among the studies. It s average value of .13 is similar to that of IQ, but coefficients are more variable. The best predictor in three of the four studies is occupational status but it does not play the dominant role that education did in Table 21.9 or IQ did in Table 21.8. Hence, if there is a gatekeeper for income, it is likely to be occupational status, but its role is not as strong as that of IQ for education or education for occupational status.

A Complete View: Areas of uncertainty

In completing a puzzle where the final picture is unknown, it is possible to make startling errors. Part of the puzzle that seems to be a large polka-dotted balloon may turn out to be a clown’s tunic. Hence, it becomes important to describe the limitations and uncertainties of the puzzle.

We have only incomplete and fuzzy estimates of the extent to which genes for IQ are correlated with genes for educational attainment, occupational status, and income. Granted, there are good data using large samples for *some* of these correlations (Taubman, 1976) and data on small samples for others (e.g., Lichtenstein et al., 1997). But we lack a large body of evidence using large samples for all the genetic correlations that we would like to estimate with confidence. To complicated matters, data come from all over the industrialized world. There may be important differences between nations that influence genetic estimates.

One of the largest areas of uncertainty lies in the definition of the IQ score. Although it is the best single number to describe the results of many different intellectual and cognitive tasks, it is not the *only* way to summarize a large number of responses. One could measure specific aspects of intelligence—vocabulary, reading comprehension, mathematical reasoning, spatial ability, memory, etc.—and then do a genetic analysis of social status using all these scores instead of a single number. The available data suggests that these specific cognitive abilities (as they are often called) are heritable, but we simply do not know how the genes for these traits relate to eventual social status. It could very well turn out that we have *underestimated* the influence of genes for cognition on social stratification because we interpreted data based on the single number measuring *g*.

Many cognitive psychologists, while recognizing the predictive power of the IQ score, favor studying cognition using more refined variables such as executive functioning, working memory, etc. Other scholars criticize the IQ score because—logically at least—it does not does include practical intelligence or social intelligence. Once again, there are no twin or adoption data to using these approaches for measuring cognition and intelligence. Many scholars hypothesize that the additional variables will add to the predictability of social status variables and/or be better predictors themselves than a single IQ score. If this is the case and if these other variables—like virtually all behavioral traits—have a moderate heritability, then we are likely to have once again underestimated the extent that genes for intelligence also influence individual differences in social status.

We also lack twin and adoption data on how well genes for that unknown conglomeration of vocational goals, interests, personality, and motivational differences are associated with social status. These are not cognitive variables per se, but they may be very important for understanding the heritability of education, occupation, and income.

One glaring lack of research is into the heritability of school grades, one of the direct criteria used for admission to colleges and then to graduate and professional schools. If grades and scores on the SAT or ACT were directly entered into the equation predicting educational level for Table 21.8, then the predictive effect of IQ score may be greatly diminished.

Genes, IQ Scores, and Social Policy

An acerbic debate over genes, intelligence, and the very social fabric of society has persisted from Galton's time to the present. In Victorian England, cries echoed about the demise of the English population because the lower classes—presumably of lower intelligence—were having more offspring than the advantaged classes. Today, such a phenomenon has been termed "dysgensis" (Herrnstein & Murry, 1994) with the tacit assumption that, if left unchecked, the very pillars of modern social structure may crumble. It is not the province of a book like this one to advocate one social policy over another. However, it is important to bring up issues that a thoughtful reader must mull over in coming to his/her own conclusions.

First consider the term "dysgenesis." The prefix "dys" means bad or ill. Combined with "genesis" the term implies an ill, bad, or less-than-optimal genetic trend. Applied to intelligence, dysgenesis carries the implicit assumption that high intelligence is good (eugenic) and low intelligence is bad (dysgenic). This is clearly an issue of *values*. All things being equal, a majority of us wish for high intelligence in our children. But that majority quickly becomes a minority when the "all things being equal clause" is violated. If given a choice, which type of child would you prefer—a highly intelligent one who goes through life as a very unhappy person or a very happy one with less than average intelligence?

Human intelligence has advanced medicine, energy resources, transportation, commerce, and communication in ways unimagined a century ago. Has this been good for our species? Balance for a moment the advances in modern medicine with the problems of increased population growth and utilization of resources that accompany those same advances. Our "intelligent" societies may be burning enough fossil fuels to change the ecology of the planet. Is this "better" or "superior" to a simple hunter-gatherer society that travels here and there to live off the land? Maybe "dysgenesis" involves high symbolic reasoning and its associated technocracy while "eugenesis" implies a more ecological melding of human behavior within planetary limitations. Which is really "good"?

In addition to the issue of values, there are good scientific reasons to question issues of differential reproduction as a function of IQ. Predictions often take current reproductive trends and extrapolate them well into the future. Yet empirically, reproductive trends can change quite quickly, negating long-term predictions. Examine the past century: the high birth rate among immigrant families at the turn of the 20th century, the reduction in birth rates accompanying the great depression, the post World War II baby boom, and the rise in childless career women toward the end of the century. If there is one thing to be learned, it is that major social factors are associated with increases and decreases in fertility. How well then can one extrapolate from cross-sectional data to broad evolutionary trends that may only be measured over tens of generations?

To give a concrete example, in the middle of the 20th century, Higgins, Reed, and Reed (1962) demonstrated a slightly positive fitness effect for IQ—just the opposite of "dysgenesis." They report that previous studies in this area never counted low IQ individuals who did not reproduce at all. Individuals with lower IQ, when they do indeed reproduce, have more children than individuals with higher IQs. The confounding factor is that individuals with low IQs simply do not reproduce as often as those with higher IQs. To give a hypothetical example, consider 100 individuals with low IQ and 100 individuals with high IQ. Fifty percent of the low IQ folks actually reproduce; of these low IQ individuals who do in fact reproduce, they have an average of 3 offspring. Hence, of the 100 low IQ people, the next generation gets 100*.5*3 = 150 gene copies. Of the 100 individuals with high IQs, 90% reproduce, but on average they have only 2 children (one less than the low IQ folks who reproduce). Their contribution to the next generation is 100*.9*2 = 180 gene copies. Obviously, the number of gene copies left by the high IQ folks (180) is greater than those left by the low IQ people (150). Is the same trend going on today? Only sound empirical data can answer that question.

Another crucial scientific observation that must always enter policy debates is the Flynn effect described earlier in this chapter. Even if there is a selective advantage for low IQ, the mean population IQ has been *increasing*, not decreasing, over the past 100 years. Passionate argument accompanies speculation about the source behind the Flynn effect. Some, including Flynn himself, suspect that there has really been no change in the physiology behind intelligence. Instead, they argue that the rise in mean IQ scores is due to increasing sophistication in test taking. Assume for the moment that this is true. Then how much of the observed IQ difference between low and high social status individuals is due to test-taking sophistication? Certainly, any projections about "dysgenesis" must take into account differences in test-taking ability.

On the other hand, there are well documented, long-term secular trends that definitely involve physiological changes. The increase in average height and the decrease in age of menarche are two examples. Perhaps some of the Flynn effect includes poorly understood changes in anatomy and/or physiology over time. Nutrition is one obvious candidate but most studies have not reported significant effects for nutrition save for extreme starvation. With the advent of radio and later television, children may have been exposed to a wider variety of problem-solving tasks as the century progressed. And two very definite results have come out of the neuroscience literature—human brains mature long after birth and, in rodents at least, experience does change the brain.

Lastly, we must recognize that industrialized societies have not in fact collapsed, as the Victorian doomsayers predicted they would, because of excessive population growth at the bottom of the IQ curve.

Many readers who reflect on these issues will conclude that the scientific terrain relevant for social policy includes large dataless deserts and swamps. There are vast areas of the puzzle where theoreticians enthusiastically claim the puzzle pieces fit but the common-sense observer raises an eyebrow. One last question—how confident would you be constructing social policy based on something that you really do not yet understand?

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Table 21.1. Kinship correlations for intelligence.

Kinship	Number of Studies	Number of Pairings	Correlation
MZ apart	3	65	.72
Sibs apart	2	203	.24
Bio PO apart	4	814	.22
MZ together	34	4672	.86
DZ together	41	5546	.60
Sibs together	69	26473	.47
Bio PO together	32	8433	.42
Half sibs together	2	200	.31
Cousins	4	1176	.15
Adoptive sibs	6	369	.34
Adoptive PO	6	1397	.19
Husband-wife	16	3817	.33

From T.J. Bouchard, T.J.Jr. & McGue, M. (1981). Familial studies of intelligence: A review. Science, 212: 1055-1059.

Table 21.2. Approximate percentage of the the stability of IQ attributable to genes (below the diagonal) and to the family environment (above the diagonal). Computed from Chambers (1999).

	Age in months:					
Age (months)	14	20	24	36	48	84
14		41	21	08	00	00
20	52		61	70	38	31
24	81	43		36	44	50
36	95	28	72		29	50
48	100	71	65	74		47
84	100	77	54	40	51	

Table 21.3. Twin correlations for the three variables that define social status.							
		Education		Occupational Status		Income	
Sample	Location	MZ	DZ	MZ	DZ	MZ	DZ
1	US	.76	.54			.54	.30
2	Norway	.87	.65				
3	Norway	.72	.49	.47	.27		
4	US	.75[a]	.62[a]			.56	.36
5	Australia	.85[a]	.58[a]			.68	.32

Code for Sample: 1 = Taubman (1976); 2 = pooled estimates from Heath et al. (1985); 3 = calculated from the variance components presented in Tambs et al. (1989); note that this sample partly overlaps with that of Heath et al (1985); 4 = Aus & Krueger (1994); 5 = Miller et al. (1995), see also Baker et al. (1996)

[a] Corrected for measurement error.

Table 21.4. Correlations for siblings and half-siblings raised together and apart for traditional measures of social status.

		Education			Occupational Status	Income
Genetic Relationship	Rearing Status	Study 1	Study 2	Study 3	Study 2	Study 3
Full Sibs	Together	.67	.32	.52	.01	.31
Half Sibs	Together			.42		.16
Unrelated	Together	.43	.13		.29	
Full Sibs	Apart	.38				
Half Sibs	Apart	.00				

Code for Study: 1 = Teasdale & Owen (1984); 2 = Scarr & Weinberg (1994); 3 = Rowe, Vesterdal & Rogers (1998)

Table 21.5. Phenotypic correlations between IQ scores and traditional measures of social status from five large population surveys.

	Correlation between IQ and:		
Study	Education	Occupation	Income
1	.55	.43	.35
2	.47	.36	.35
3	.56	.47	.20
4	.58	.45	.36
5	.60		.31

Code for study: 1 = Veterans data from Jencks et al. (1979, Table A2.7); 2 = PSID data set from Jencks et al. (1979, Table A2.5); 3 = Project Talent data from Jencks et al. (1979, Table A2.9); 4 = Olneck Brothers data from Jencks et al. (1979, Table A2.11); 5 = NLSY data from Rowe, Jacobsen & Van den Oord (1999).

Table 21.6. The best predictors of a person's adolescent/young adult IQ score.

	Predictor Variables:	
Data Set:	Father's Education	Father's Occ Status
Veterans	.15	.17
PSID	.16	.17
Talent	.16	.24
Olneck	.18	.18

Table 21.7. The best predictors of a person's educational level.

	Predictor Variables:		
Data Set:	Father's Education	Father's Occ Status	Own Test
Veterans	.13	.14	.49
PSID	.20	.18	.38
Talent	.15	.11	.49
Olneck	.20	.16	.49

Table 21.8. The best predictors of a person's occupational status..				
	Predictor Variables:			
Data Set:	Father's Education	Father's Occ Status	Own Test	Own Education
Veterans	.04	.10	.12	.49
PSID	.00	.06	.08	.56
Talent	.03	.02	.16	.54
Olneck	-.02	-.00	.16	.51

Table 21.9. The best predictors of a person's income.					
	Predictor Variables:				
Data Set:	Father's Education	Father's Occ Status	Own Test	Own Education	Own Occ Status
Veterans	-.05	.17	.21	.01	.25
PSID	-.01	-.01	.17	.24	.20
Talent	.07	-.02	.07	.08	.15
Olneck	-.01	.05	.14	.17	.23

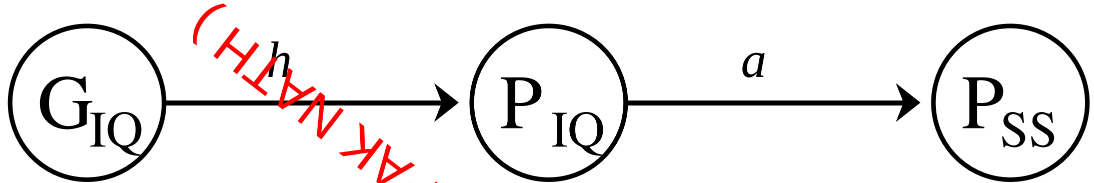

Figure 21.1. The Murrnstein Model: Genes for IQ (G_{IQ}) influence phenotypic IQ (P_{IQ}) which then influences eventual social status (P_{IQ})

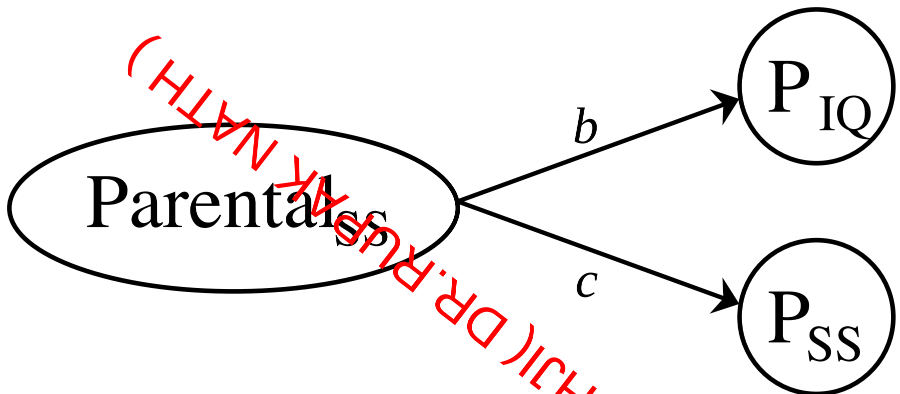

Figure 21.2. The Rosemintin Model: Parental social status (Parental$_{SS}$) jointly influences offspring IQ (P_{IQ}) and offspring social status (P_{SS}).