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Intelligence and socioeconomic success: A meta-analytic review of longitudinal research ☆

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Abstract

The relationship between intelligence and socioeconomic success has been the source of numerous controversies. The present paper conducted a meta-analysis of the longitudinal studies that have investigated intelligence as a predictor of success (as measured by education, occupation, and income). In order to better evaluate the predictive power of intelligence, the paper also includes meta-analyses of parental socioeconomic status (SES) and academic performance (school grades) as predictors of success. The results demonstrate that intelligence is a powerful predictor of success but, on the whole, not an overwhelmingly better predictor than parental SES or grades. Moderator analyses showed that the relationship between intelligence and success is dependent on the age of the sample but there is little evidence of any historical trend in the relationship.

Keywords: Intelligence; Socioeconomic success; Career success; Status attainment; Meta-analysis

Contents

☆ A detailed Appendix to this meta-analysis is available at www.zone.ee/tstrenze/meta.xls. The author wishes to express his gratitude to the reviewers for their helpful comments.
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1. Introduction

Decades of research on human mental abilities have demonstrated that the scores of intelligence tests are positively correlated with several desirable outcomes and negatively correlated with several undesirable outcomes. One of the central and personally most relevant desirable outcomes is socioeconomic success (or career success), which is usually measured by the educational level, occupational prestige, and income of an individual in adulthood. Although it is sometimes claimed in popular press and textbooks that intelligence has no relationship to important real-life outcomes (see Barrett & Depinet, 1991, for a review of such claims), the scientific research on the topic leaves little doubt that people with higher scores on IQ tests are better educated, hold more prestigious occupations, and earn higher incomes than people with lower scores (Gottfredson, 1997, 2003; Jensen, 1980, 1998; Schmidt & Hunter, 2004).

Thus, the existence of an overall positive correlation between intelligence and socioeconomic success is beyond doubt. But quite surprisingly, the mere existence of this correlation seems to be the only fact that is established beyond doubt after many decades of research. Several major questions are still without definite answers and continue to arouse heated debates (the debate about *The Bell Curve* being a prominent example in recent decades; see Herrnstein & Murray, 1994; Fischer et al., 1996). First, what is the approximate size of the correlation between intelligence and success? Is it large enough to be of any practical importance? While some researchers have said that this correlation is *"larger than most found in psychological research"* (Schmidt & Hunter, 2004: 162), others are convinced that "*IQ is just not an important enough determinant of economic success*" (Bowles & Gintis, 2002: 12). Second, how does the predictive power of intelligence compare to the predictive power of other variables, such as parental socioeconomic status (SES) or school grades? On the one hand there are studies showing that "*individual ability is by far the strongest influence on occupational achievement*" (Bond & Saunders, 1999: 217). And yet other studies conclude that "*the effect of socioeconomic background on each of the three adult status variables – schooling, income, and occupational status – is greater than the effect of childhood IQ*" (Bowles & Nelson, 1974: 44). Third, are there any age-related or historical changes in the relationship between intelligence and success? The question of historical changes in the importance of IQ has been particularly controversial with some authors warning against increasing cognitive stratification (Herrnstein

& Murray, 1994) and others trying to disprove these claims (Hauser & Huang, 1997).

The present paper will address these questions by conducting a meta-analysis of the longitudinal research on the relationship between intelligence and socioeconomic success. I will concentrate on longitudinal studies (where intelligence is measured before the actual success) because only longitudinal research design allows us to make conclusions about the possible causal impact of intelligence on success.

2. A brief history

Longitudinal studies on the relationship between intelligence and career success have been conducted since the first decades of the 20th century (Ball, 1938; Thorndike et al., 1934). And these studies have invariably uncovered a positive relationship. The early studies, however, did not consider other possible determinants of success, most importantly parental SES. Therefore, they were open to the criticism that the positive relationship between intelligence and success might actually be the result of parental SES influencing them both (Bowles & Gintis, 1976; McClelland, 1973). At the end of 1960s, with the inception of the status attainment research paradigm, investigators started to construct more sophisticated models of career advancement that considered several determinants of success at the same time (Duncan, 1968; Jencks et al., 1972; Sewell, Haller, & Ohlendorf, 1970).

But it was with the publication of The Bell Curve in 1994 (Herrnstein & Murray, 1994) that the question of intelligence and socioeconomic success really came to public attention. Analyzing a representative longitudinal data set from the United States, Herrnstein and Murray found that intelligence is a better predictor of several desirable outcomes (e.g., not living in poverty, not being arrested) than is parental SES. They also found evidence that the role of intelligence in status attainment has been growing throughout the 20th century and concluded that the social structure of American society is increasingly based on mental ability. The ideas of The Bell Curve have been severely criticized for a number of reasons. Fischer et al. (1996) argued that Herrnstein and Murray used an inappropriate measure of parental SES and, therefore, underestimated its importance. Hauser and Huang (1997) argued that the claim about the growing importance of intelligence is simply a misinterpretation of previous research. Other researchers have, however, supported the ideas of The Bell Curve (Gottfredson, 2003; Jensen, 1998) saying that its central claims have been convincingly confirmed (Nyborg, 2003: 459).

At the same time in Great Britain, a similar discussion was inspired by the work of Saunders who, analyzing a representative longitudinal data set from Great Britain, found that intelligence is a better predictor of occupational attainment than is parental SES and concluded that England is, to a large extent, a meritocratic society (Bond & Saunders, 1999; Saunders, 1997, 2002). These conclusions were challenged by Breen and Goldthorpe (1999, 2001) who argued that Saunders greatly overestimated the importance of intelligence by using inappropriate analytic techniques.

3. Previous reviews

There have been surprisingly few attempts to systematically review the literature on intelligence and socioeconomic success. Reviewers typically cite only a couple of studies (see e.g., Brody, 1997; Farkas, 2003; Schmidt & Hunter, 2004). Some of the most comprehensive reviews have been conducted by Jencks (see Jencks et al., 1972, 1979). Two meta-analyses have so far addressed the relationship between intelligence and socioeconomic success. Both of them used income as a measure of success. The more comprehensive one of the two was conducted by Bowles, Gintis, and Osborne (2001). They assembled 65 estimates from 24 studies to estimate the relationship between intelligence and income. The mean standardized regression coefficient of intelligence on income is .15 according to their study (p. 1154). In addition to that, Bowles et al. (2001) reported that there is no time trend in the size of the coefficients between the years 1960 and 1995 and that the age of the sample at the time of ability testing has no effect on the results.

The meta-analysis of Bowles et al. is a valuable contribution but it suffers from several shortcomings. First, it considered only one measure of success, income, thereby ignoring education and occupation. Second, the meta-analytic estimate of .15 was not derived from zero-order correlations as is usually required by the textbooks of meta-analysis (see Hunter & Schmidt, 2004: 475) but from regression equations that included several predictors in addition to intelligence. Peterson and Brown (2005) have recently suggested that the use of partial effect sizes, instead of zero-order ones, does not affect the meta-analytic results very much but it is nevertheless obvious that the use of disparate studies makes the results difficult to interpret. Third, the meta-analysis of Bowles et al. was not based on independent samples. The authors stated that they used 65 estimates from 24 studies (p. 1154) but neither of these figures represents the number of independent samples. Inspection of the appendix (not published but available from the authors) leaves no doubt that some samples contributed more than one coefficient to the final meta-analytic estimate thereby ignoring the requirement of independent data (see Hunter & Schmidt, 2004, chapter 10). Fourth, their meta-analysis mixed cross-sectional and longitudinal studies. The distinction between cross-sectional and longitudinal study design is vital in the present context because only the latter can answer questions about the causal impact of intelligence on career success.

Another, more recent, meta-analysis was conducted by Ng, Eby, Sorensen, and Feldman (2005) who collected 8 studies and found an average correlation of .27 between intelligence and salary. The meta-analysis of Ng et al. (2005) was, unlike the one by Bowles et al., based on zero-order correlations and avoided the use of non-independent samples but it failed to separate cross-sectional and longitudinal studies.

4. Topics addressed in the present paper

4.1. The size of the correlation between intelligence and success

Meta-analyses are often conducted with the aim to determine if a statistical relationship between two variables is significantly different from zero. This cannot be the only aim of the present meta-analysis because very few social scientists would doubt that there is a positive correlation between intelligence and socioeconomic success. Having acknowledged that, the next logical question is: what is the approximate size of the correlation? Answers to this question are far from uniform. Take the correlation between intelligence and income: Jensen has suggested that it is somewhere around .40 (Jensen, 1998: 568) while Bowles et al. (2001) have found that it is only about .15. That is why the first aim of the present meta-analysis is to estimate the approximate sizes of the correlations between intelligence and measures of success. The importance of the correlations can be evaluated using Cohen's classification scheme which classifies correlations as small if they are below .30, medium-sized if they are between .30 and .50, and large if they are over .50 (Cohen, 1988). Knowing the size of the correlation between intelligence and career success would allow us to compare it to other, well-established, correlations in the social scientific literature; e.g., the correlation of .51 between intelligence and job performance (Schmidt & Hunter, 1998).

4.2. Intelligence and other predictors of success

It is difficult to evaluate the importance of a predictor in isolation; it would be informative to compare the predictive power of intelligence to the predictive power of other relevant predictors of socioeconomic success. This paper will, therefore, analyze two additional predictors – parental SES (e.g., father's occupation) and academic performance (e.g., school grades) – with the aim to determine if intelligence is a better predictor of success than the other two variables. Parental SES and academic performance have often been treated as the main "competitors" of intelligence in predicting career success because, as explained shortly, they represent different views about a typical path to success. Including them in this paper will, consequently, allow us to better evaluate the role of intelligence in people's career.

4.2.1. Intelligence versus parental SES

The question about the relative importance of intelligence and parental SES in predicting success is one of the central questions of status attainment research. This is a question about the nature of the society we live in: whether a typical western society rewards people for their own abilities or their social background (Saunders, 1997; Turner, 1960)? But we are far from having a definite answer to this question. Some authors have found that intelligence outcompetes parental SES as a predictor (Herrnstein & Murray, 1994; Murray, 1998; Saunders, 1997). Others have replied that parental SES, if properly measured, is actually a better predictor (Bowles & Nelson, 1974; Fischer et al., 1996). The seemingly greater predictive power of intelligence in some studies results from the failure to correct for measurement error in the measures of parental SES (Bowles & Nelson, 1974) and the failure to include important aspects of parental status (most importantly, parental income) among the predictors (Bowles & Nelson, 1974; Fischer et al., 1996).

Therefore, it is necessary to compare the correlation between intelligence and success with the correlation between parental SES and success. To accomplish that, the present paper will include a meta-analysis of the relationship between the different aspects of parental SES (parental education, occupation, and income) and socioeconomic success. Research on this relationship is, of course, voluminous and several narrative and quantitative reviews of it are available (see Ganzeboom, Luijkx, & Treiman, 1989; Haveman & Wolf, 1995; Mulligan, 1999). Ganzeboom et al. (1989), for instance, gathered 149 studies from 35 countries to analyze the association between father's occupation and son's occupation, and concluded that the association is stronger in non-industrialized societies and has been weakening during the 20th century. But none of these reviews has presented the results in a manner that would make them directly usable in this paper, hence the need for a separate meta-analysis.[1]

4.2.2. Intelligence versus academic performance

The question about the relative importance of mental ability and academic performance in predicting success has also been recognized as important (see Jencks & Phillips, 1999). It is a question of what really matters for career success: is it one's general ability (as measured by IQ tests) or the things one has learned at school and motivation to learn (as measured by school grades)? Not many studies have explicitly compared the predictive power of IQ scores and school grades (e.g., Taubman & Wales, 1974, chapter 3). But the more general question about the usefulness of grades as predictors of success has been the object of considerable debate (see Roth, BeVier, Switzer, & Schippmann, 1996; Roth & Clark, 1998). The meta-analysis by Roth and Clark (1998), for instance, found an average correlation of .28 between grades and salary. Thus, contrary to some earlier claims (e.g., McClelland, 1973), grades have turned out to be good predictors of success. This literature is somewhat limited by being almost exclusively restricted to college grades. If the purpose is to compare grades and IQ test scores as predictors of career success, then high school grades would be a better choice because college students constitute a rather selected group that does not represent the full range of career attainments in society. High school grades have been meta-analytically related to job performance (Dye & Reck, 1988) and college grades (Robbins et al., 2004) but there is currently no meta-analysis about the relationship between high school grades and general socioeconomic success (as measured by education, occupation, and income). The present paper will, thus, conduct such a meta-analysis.

4.3. Moderators of the correlation between intelligence and success

In order to further clarify the role of intelligence in people's career, the effects of three moderator variables (age at testing, age at success, and year of success) on intelligence–success correlation will be studied. These moderator variables have been analyzed in several studies but with rather conflicting results.

4.3.1. Age at the time of testing

The first moderator analysis concerns age at testing (age of individuals at the time the IQ test was taken) and how it affects the correlation between intelligence and success. Analysis of the effect of age at testing reveals something about the mechanism behind the intelligence–success correlation. If intelligence predicts success irrespective of the age at which it is measured, then there is reason to believe that the differences in people's career success are the result of the stable individual differences measured by IQ tests (Jencks & Phillips, 1999). If however, the predictive power of IQ tests changes with age, then different interpretations are possible depending on how we believe the test score to be affected by genes and environment. According to the standard sociological interpretation, the test scores of older individuals should be more affected by life experiences than the scores of children (because older individuals simply have had more experiences) and consequently, if intelligence tested at an older age should turn out to be a better predictor career success, then it would mean that the test scores probably reflect some career-relevant experiences which the older individuals have had more time to accumulate (Jencks & Phillips, 1999). The other interpretation is based on behavior genetic research which has found that genetic influences on IQ scores increase with age and environmental influences decrease (McCartney, Harris, & Bernieri, 1990); from these results one can conclude that if the test scores of older individuals are better predictors of success, then it can be attributed to the growing effect of some career-relevant genes.[2]

Empirical evidence concerning age at testing is rather contradictory. A study by McCall (1977) found a clear upward trend in the correlations between intelligence and success; that is, correlations grew stronger as age at testing increased. Some of the studies reviewed by Jencks and Phillips (1999) have found a similar trend. The meta-analysis of Bowles et al. (2001), however, found that age at testing has no effect on the association between intelligence and income. Jencks et al. (1979) reached a similar conclusion in their review.

[1] Ganzeboom et al. (1989) analyzed social mobility tables, Mulligan (1999) analyzed bivariate unstandardized regression coefficients; for this paper, however, bivariate *standardized* regression coefficients (i.e., correlations) are needed.

[2] I am grateful to a reviewer for pointing this interpretation out to me.

4.3.2. Age at the measurement of success

A related issue concerns the age of the individuals at the time their career success is measured. According to the so-called gravitational hypothesis, the correlation between intelligence and success should grow stronger as individuals grow older because (as a result of self-selection and competition) individuals "gravitate" towards the positions that correspond to their ability levels as they progress in their careers. This reasoning has been used to support the idea that intellectual differences cumulate over life course and become progressively more important (see Gottfredson, 2003; Wilk & Sackett, 1996). Other researchers have suggested that exactly the opposite is true: the predictive validity of IQ scores should decline as time goes by because less able people have time to accumulate skills to compensate for their initial lack of ability (Ackerman, 1987; Keil & Cortina, 2001). These opposing views can be reconciled by saying that the idea of declining importance of IQ applies to the performance of specific tasks that become automatic after some practice and the idea of growing importance applies complex long term activities, such as attaining and maintaining social status, that never cease to be cognitively demanding. But so far as socioeconomic success can depend on the performance of specific work tasks, the possibility of declining validity of IQ is not completely ruled out.

Several studies have correlated intelligence with success at different points in people's life course. Some of them have found that the correlations indeed increase with age as predicted by the gravitational hypothesis (Brown & Reynolds, 1975; Deary et al., 2005; Wilk & Sackett, 1996), others have found no clear trend (Hauser, Warren, Huang, & Carter, 1996; Warren, Sheridan, & Hauser, 2002). The reviews by Hulin, Henry, and Noon (1990) and Keil and Cortina (2001) found support for the declining validity thesis but it should be noted that many of the studies reviewed in these papers used specific laboratory tasks as dependent variables and are, therefore, not directly comparable to the studies reviewed in the present paper.

4.3.3. Year of the measurement of success

A particularly controversial issue concerns the historical changes in the relationship between intelligence and success. It was one of the central claims of The Bell Curve that the association between mental ability and career success in western societies has been growing throughout the 20th century (Herrnstein & Murray, 1994). The logic behind this idea is similar to the gravitational hypothesis, discussed in the previous section – in both cases individuals are increasingly drawn towards the positions that correspond to their ability as time goes by – but in this case the gravitation does not take place during a life course of a single individual but over several generations.

Several studies have investigated changes in the association between intelligence and success during past decades. Although Herrnstein and Murray concluded that "*the main point seems beyond dispute*" (1994: 52) and some studies have found support for this point (Murnane, Willett, & Levy, 1995), there are still serious reasons to doubt that the importance of intelligence is or has been growing. Neither the meta-analysis by Bowles et al. (2001) nor the review by Jencks et al. (1979) found any clear trend in the correlations between intelligence and success. The same conclusion was reached by Flynn (2004) and Hauser and Huang (1997). Breen and Goldthorpe (2001) found that the association between intelligence and occupational status in England is, if anything, declining.

5. Method

5.1. Definition of variables

The present meta-analysis investigated the relationship between three measures of socioeconomic success (educational level, occupational level, and income) and three predictors (intelligence, parental SES, and academic performance). The operationalization of these variables is described next.

5.1.1. Socioeconomic success

Educational level was measured by the number of years spent in full time education or the highest level of education completed. Occupational level was typically measured by such occupational scales as Duncan Socioeconomic Index, International Socioeconomic Index of Occupational Status, NORC prestige scale, etc. These scales provide detailed numerical measures of occupational status (see Ganzeboom & Treiman, 1996a, for a general discussion). In some studies, less detailed occupational classifications were used. Irrespective of the level of detail, all the occupational variables in this paper had a common property of ordering occupations on a single hierarchical dimension with higher values designating more desirable and prestigious occupations. Income was measured by salary or total monetary income, which had to refer to the personal income of an individual, not to family or household income. If possible, I preferred income measured on a logarithmic scale because logarithmic transformation removes the skew typically found in income distribution.

5.1.2. Intelligence

Intelligence, or general mental ability, of an individual was measured by a score on a test of intelligence. It is not always easy, however, to decide if a given test is a test of intelligence. The definitions of intelligence state that it is an abstract ability that is not tied to any specific domain of knowledge. Therefore, only the tests that are designed to measure such ability should be used in the meta-analysis. If we take the traditional threefold distinction between ability, aptitude, and achievement tests (Jensen, 1981), then the present study should use only ability and aptitude test scores. Although some researchers have contended that achievement tests can also be treated as measures of general ability (Boudreau, Boswell, Judge, & Bretz, 2001), and even everyday life can be interpreted as an IQ test (Gordon, 1997), the present study took a more conservative approach and included only those tests that are generally regarded as tests of intelligence (see e.g., Anastasi & Urbina, 1997; Jensen, 1980, chapter 7, for a discussion and classification of different tests).

There are numerous "classical" tests (e.g., Henmon–Nelson, Lorge–Thorndike, Otis–Lennon, Raven Progressive Matrices, Stanford–Binet, Wechsler tests) for which there seems to be a general consensus that these are indeed tests of general mental ability. Such multiple aptitude test batteries as Armed Services Vocational Aptitude Battery or General Aptitude Test Battery are also often treated as measures of general ability. The most problematic ones are the tests that are specifically constructed for use in a single data set. Such unique tests have been used in several large and influential data sets (e.g., National Child Development Study, National Longitudinal Survey of High School Class 1972, Panel Study of Income Dynamics, Project Talent). In these cases I consulted the manuals of the data sets and studies that are based on the data. If the test was derived from other IQ tests or if it was described as a test of intelligence, then I included it in my study. Studies using well-known achievement tests, such as Iowa Test of Basic Skills (Smokowski, Mann, Reynolds, & Fraser, 2004), were excluded. The names of all the IQ tests used in this paper are listed in the Appendix.

5.1.3. Parental SES

Five measures of parental socioeconomic status (SES) were used in this paper; the first four were father's education, mother's education, father's occupation, and parental income. The measurement of these variables was similar to the measurement of respondent's own education, occupation, and income (see above). Parental income refers to father's income or total income of parents. Because too few studies reported data on mother's occupation, this variable was not included. In addition to these four, I also used a general index of SES, which combines several parental characteristics into one variable. A number of studies have used a composite index on the assumption that it is a better indicator of social advantages than any of the single variables that make up the index and, therefore, also a better predictor of success (see White, 1982, for supporting evidence). A correlation with SES index was included in the present meta-analysis if the index was composed of the following components — parental education (education of one or both parents), parental occupation (occupation of one or both parents), and material well-being of the parental home. The latter was measured by parental income or by a "possession index" which indicates how many of the valued items (e.g., a car, TV set, computer) were present at home. If a study did not use an index of SES but presented intercorrelations among the necessary variables, then I used the formulas reported by Hunter and Schmidt (2004: 433) to calculate a composite score correlation between SES index and success.

5.1.4. Academic performance

Academic performance was in most studies measured by a grade point average (GPA) obtained in high school or the years preceding high school. In some studies, rank in class (i.e., how well the student performed in comparison with other students in the class) was used instead of GPA. Rank is generally used interchangeably with GPA (see Kuncel, Crede, & Thomas, 2005), therefore, these studies were also included.

5.2. Collection of data

Studies were identified for inclusion in the meta-analysis by searching computerized databases (such as JSTOR, PsycINFO) using terms like "status attainment", "educational attainment" "occupational attainment", "socioeconomic achievement" as keywords. Reference sections of review papers were also searched.

To be included in the meta-analysis, the following general criteria had to be met. First, the measurement of the variables had to correspond to the descriptions presented in Section 5.1. Second, the data had to be longitudinal; that is, the predictors (intelligence, parental SES, and academic performance) had to be measured at an earlier time and career success (education, occupation, and income) at a later time.[3] Third, the interval between the measurement of predictors and dependent variables had to be at least 3 years because studies with shorter intervals would have very little advantage over cross-sectional studies. Fourth, the study had to report a zero-order correlation between the variables and another measure of association transformable into a zero-order correlation.

Fifth, majority of individuals in the sample had to be at least 20 years old at the time the career success was measured because it makes little sense to talk about the career success of individuals younger than 20. Sixth, majority of individuals had to be less than 25 years old at the time the IQ test was taken because, to properly investigate the effect of intelligence on career, intelligence should be tested before the individuals start a career. Obviously, even individuals tested in their early twenties might already have started a career, but since these individuals can be used for comparison with younger individuals, they were included. Information on parental SES and academic performance had to refer to the time the respondents were approximately 12–18 years old (the time these variables presumably have their greatest impact on subsequent career). Seventh, the study had to be conducted in a “western” society; that is, in the United States, Canada, Europe, Australia, or New Zealand. Additional criteria are described in Section 5.4.

It is rather common for published studies not to report the information necessary for meta-analysis (the lack of zero-order correlations is a typical problem). But fortunately, the raw data of several well-known data sets (e.g., General Social Survey, National Longitudinal Survey of Youth) are available for public use. Because it would be a serious waste of information to leave these sources unused, I decided to use the available raw data to calculate the correlations if none of the published sources reported the necessary information or if the information in the published source was deficient in some way (e.g., if the correlations were reported separately for men and women but not for the complete sample). Most of the raw data sets had been prepared for public use and contained all the necessary variables in a ready-to-use form. In some cases, minor statistical procedures were implemented before calculating the correlations (e.g., summing the standardized scores of subtests to obtain the score of general intelligence; transforming the original occupational variable into a more appropriate prestige scale using the methodological tools provided by Ganzeboom and Treiman (1996b). The raw data sets used in this paper are listed in the Appendix.

Several longitudinal data sets contain data from more than one follow up. Career success has been measured repeatedly for the same individuals in these data sets (up to 20 times in some cases). In some data sets, the predictors (intelligence, parental SES, or academic performance) have also been measured repeatedly. In order to ascertain that every sample contributed only one correlation to one analysis, I averaged all the correlations that were derived from the same sample. If the sample sizes of the averaged correlations were different, mean sample size was used. The procedures for moderator analyses are described in Sections 6.3 and 6.4.

5.3. Correcting for unreliability

Ideally, every correlation should be corrected with the reliability coefficients obtained from the same sample as the correlation that needs to be corrected (Hunter & Schmidt, 2004, chapter 3). However, such reliability coefficients were available for only a small minority of studies included in the present meta-analysis. The correlations from these studies were corrected with these reliability coefficients. But for the majority of studies, mean reliabilities (estimated from various sources, as described below) were used. Each study was then corrected individually with the appropriate reliability coefficient. The nature and sources of reliability information are described next.

5.3.1. Socioeconomic success

Information on education, occupation, and income can be obtained from three sources. The first source is institutional record (e.g., tax records of income). Following the common practice, data from such objective sources were assumed to have a reliability of 1. The second and by far the most common source is self-report. Self-reports are not perfectly reliable, however. The amount of error is usually measured by asking the same individuals to report their socioeconomic characteristics again after a few months and then correlating the first and second reports (producing a test–retest

[3] That does not mean that all the studies had to actually include at least two waves of measurement because one of the predictors, parental SES, can be measured retrospectively (by asking adult respondents questions like “what was your father’s occupation at the time you were 16?”). It is important, however, that the information about father’s occupation or parental income obtained from adult respondents refers to parents’ *past* (not current) occupation or income. The latter requirement was not applied to parental education because parents’ education is unlikely to change while children grow up. In some studies (e.g. Duncan & Hodge, 1963), father’s occupation was rather vaguely referred to as father’s “usual occupation” or “longest occupation”. These studies were also included.

correlation). Several estimates of these correlations, derived from nationally representative samples, are available. Using the data presented by Bowles (1972) and Jencks et al. (1979), I calculated the average test–retest correlations for educational level (.89), occupational status (.88), and income (.83). These values were used to correct the correlations with self-reported socioeconomic success. The third possibility is to obtain the information from the spouse, parent, sibling, or child of the focal individual. Because these sources would introduce unnecessary complications and an unknown degree of error, the studies using these sources were excluded unless they contained correlations between intelligence and success (these correlations are too valuable to be discarded).[4]

5.3.2. Intelligence

When correcting for unreliability in the test scores, test–retest alternate-form reliability (the correlation between parallel forms of the same test administered on two separate occasions) is generally considered to be the most appropriate form of reliability (Schmidt & Hunter, 1999). But since these coefficients are rarely available, simple test–retest reliability is often taken as the second best option in meta-analytic studies of the predictive power of IQ scores (Judge, Colbert, & Ilies, 2004; Salgado, Anderson, Moscoso, Bertua, & Fruyt, 2003). Because test–retest reliability coefficients were reported in only a few studies, an average test–retest coefficient, obtained from the meta-analysis of Salgado et al. (2003), was used for most of the studies. Salgado et al. averaged 31 test–retest correlations of different general mental ability tests (the mean interval between test and retest being 6 months) and obtained an average coefficient of .83. This value is similar to average test–retest correlations obtained in other reviews: e.g., .82 in Parker, Hanson, and Hunsley (1988) or .85 in Kuncel, Hezlett, and Ones (2004). Thus, the reliability of .83 seems to be a representative estimate and was used in the present study.

5.3.3. Parental SES

The information on parental education, occupation, and income can come from three sources. First, it can be reported by the parents themselves. If this was the case, then the correlations were corrected with the same reliability coefficients that were used for self-reported education, occupation, and income. Second, it can be reported by the children. Children's reports on parental characteristics are known to suffer from considerable error. Probably the best estimate of this error is the correlation between child's report and parent's own report on a given characteristic. Looker (1989) has presented a comprehensive review of these correlations for father's education, mother's education, and father's occupation. Using the information in Table 3 in Looker's paper, I calculated the average correlations between child's report and parent's report. The average correlations are .80 for father's education, .79 for mother's education, and .78 for father's occupation. These values were used to correct the correlations that involved children's reports on parental SES.[5] Information on the reliability of children's reports on parental income is harder to find. I could locate two studies (Bell, Senese, & Elliott, 1984; Massagli & Hauser, 1983) that provided reliability estimates from three samples. The estimates ranged from .45 to .59. with an average of .51 that was used in the present paper. The third source of information on parental SES is objective data (e.g., tax records of income) that was assumed to have a reliability of 1. Internal consistency method (Cronbach alpha) was used to correct for unreliability in the SES index. This method was recommended by Hunter and Schmidt (2004: 438) for composite variables. For all but two studies, the alpha value of the SES index was obtained from the same sample as the correlation itself. For the remaining two, the average alpha of all the other studies (.71) was used.

5.3.4. Academic performance

If the information on academic performance (GPA or class rank) was obtained from school records, it was assumed to have a reliability of 1. Students' self-reports on their GPA or rank are, of course, not perfectly reliable. The reliability of self-reports is assessed by the correlation between self-reported GPA (or rank) and GPA (or rank) obtained from school records. A recent meta-analysis by Kuncel et al. (2005) found that this correlation is .82 for high school GPA and .77 for high school rank. These values were used to correct the correlations that involved self-reported GPA or rank.

[4] In the study by Vroon, Leeuw, and Meester (1986) the dependent variable (occupation) was reported by the child of the focal respondent. For this study the reliability of children's report on father's occupation was used.

[5] Children's reports on parental SES can further be divided according to the age of the child at the time of reporting. When calculating the average reliabilities from Looker's (1989) data, I excluded the samples of children younger than 9th grade because the reports of such children were not used in the present meta-analysis.

5.4. Correcting for range restriction and dichotomization

No mathematical correction for range restriction was performed in the present meta-analysis. Instead of that, the correction was done indirectly by excluding studies with considerable range restriction. This strategy was preferred because most of the studies that satisfied the inclusion criteria (see Section 5.2) were based on samples that were fairly representative of the general population and did not require the correction for range restriction. It is, therefore, appropriate to limit the current meta-analysis to representative studies and exclude the studies that exhibit signs of considerable range restriction.[6] More specifically, I excluded the studies that sampled only (a) college students or individuals with a college degree (e.g., Eckland, 1965), (b) employees of a single organization (e.g., Dreher & Bretz, 1991), or (c) representatives of one specific occupational group (such as engineers or managers; see e.g., Sackett, Gruys, & Ellingson, 1998).[7] These criteria exclude much of the personnel selection research, which is the kind of research where the problem of range restriction is particularly serious (see Hunter & Schmidt, 2004). I also excluded the correlation if the range of one (or both) of the correlated variables was deliberately restricted by the research design. For example, in the study of gifted children by Terman and Oden (1947), the range of intelligence was severely restricted by sampling only individuals with IQs over 135; in the Polish study by Firkowska-Mankiewicz (2002), the range of intelligence was restricted by sampling only individuals with IQs below 86 or over 130. The correlations obtained from Fergusson, Horwood, and Ridder (2005) and Kuh and Wadsworth (1991) were the only ones that had to be corrected for dichotomization.

5.5. Moderator variables

In order to investigate the issues described in Section 4.3, the following moderator variables were coded for every study: the mean age of the sample at the time of testing, the mean age of the sample at the time of the measurement of success, and the year of the measurement of success. The moderator analyses are meaningful only if every sample, included in a particular analysis, is reasonably homogenous in terms of the moderator variables (i.e., all the individuals in the sample should be of approximately the same age and studied at the same time). To achieve that, I excluded a study from a moderator analysis if the range of the moderator variable in question exceeded 10 years. It should be noted, however, that the majority of the samples that provided data on intelligence were rather homogenous in terms of all the moderator variables because longitudinal surveys typically concentrate on a specific cohort. The moderator analyses were conducted in two steps: first a more conventional subgroup analysis and then a meta-regression analysis. The details of these analyses are described in Sections 6.3 and 6.4.

5.6. Meta-analytic calculations

In order to estimate the strength of the relationship between predictors and success, three averages were calculated: a simple average correlation, a sample size weighted average correlation, and a sample size weighted average correlation corrected for unreliability and dichotomization in the correlated variables. The latter constitutes the central meta-analytic result of the present paper. Other averages can be used for comparison to see how much the results are affected by weighting and correcting the original correlations. Because the sample sizes were highly variable (from 60 to 339,951 with a median of 518), weighting the correlations by sample size would allow the few very large studies to overly dominate the results. To prevent that, all the samples with the size over 7000 individuals (about 5% of the samples in this study) were set equal to 7000 for the weighting procedure.

In order to estimate the variability of the correlations, the standard deviation of original correlations and corrected standard deviation of corrected correlations (Hunter & Schmidt, 2004: 126) were calculated. The 95% credibility intervals of sample size weighted corrected correlations were calculated to assess the presence of moderators. Moderators are present if the credibility intervals are large (over 0.11 according to Koslowsky & Sagie, 1993) or include zero (see Whitener, 1990). Finally, 95% confidence intervals of the sample size weighted corrected correlations were calculated using the formula for heterogeneous studies (Whitener, 1990: 317). Confidence intervals can be used to assess the significance of the correlations (correlation is significantly different from zero if the confidence intervals do

[6] Of course, one cannot expect the samples to be representative in terms of every possible characteristic (such as age, gender, or race). It is enough if the samples are reasonably representative in terms of the variables that are analyzed in the present study.

[7] In a couple of cases, the study itself was based on a representative sample but some of the correlations were regrettably reported only for specific occupational groups (e.g. Thorndike et al., 1934; Thorndike & Hagen, 1959). These correlations were not used.

not include zero) as well as to compare correlations (according to a simple and conservative rule of thumb, two correlations are significantly different from one another if their confidence intervals do not intersect).

6. Results

6.1. The meta-analytic database

Data from 85 data sets (135 samples) were used in the present meta-analysis; 49 data sets (65 samples) provided information on the relationship between intelligence and socioeconomic success. All the data sets used in this paper are listed in the Appendix, detailed information on the data is available at www.zone.ee/tstrenze/meta.xls. The United States is the most important source of data: 36 data sets containing information on intelligence and career success originate from the U.S.A.; United Kingdom is represented by 6 data sets, New Zealand by 2; Australia, Estonia, Netherlands, Norway, and Sweden are all represented by one data set.[8]

6.2. Predictors of socioeconomic success

Table 1 presents the general meta-analytic description of the relationship between predictors and measures of socioeconomic success. The table is divided into three sections with every section presenting the results for one measure of success. It can be observed that, for every predictor, the correlation with education is the strongest one and the correlation with income the weakest one.

The first row in every section of Table 1 presents the general results for intelligence as a predictor of success. The phrase “all studies” in parentheses indicates that all the studies that satisfied the inclusion criteria are included in these analyses. As expected, intelligence is positively correlated with education, occupation, and income; the sample size weighted and corrected correlations (p) are .56, .43, and .20, respectively. The fact that the 95% credibility intervals exceed 0.11 suggests the presence of moderators according to Koslowsky and Sagie (1993). Comparing the three averages (r, rw, and p) in every row to one another demonstrates that weighting the correlations by sample size tends to reduce the average. This means that larger studies produced smaller correlations indicating in turn that smaller, and potentially less representative, samples overestimate the correlation between intelligence and success.

The results, just described, can be criticized for including several samples that are somewhat inappropriate for studying the causal influence of intelligence on success. In some studies, most of the individuals were already in their early twenties at the time the IQ test was taken. It is possible that many individuals in these samples had already started a career by that time, which makes the direction of influence between intelligence and career success rather ambiguous. Furthermore, in several studies the individuals were still in their twenties at the time their career success was measured. It seems reasonable to assume, however, that individuals under 30 cannot yet be reliably classified as more successful or less successful. Taking these observations into account, the second row in every section of Table 1, containing the phrase “best studies” in parentheses, includes only samples with the average age of less than 19 at testing and over 29 at the measurement of success. If raw data were used, then the individuals of inappropriate age were simply excluded.

Looking at the “best studies”, we can observe the corrected sample size weighted correlations of .56, .45, and .23 between intelligence and education, occupation, and income, respectively. These correlations can be treated as the most appropriate estimates of the relationship between intelligence and socioeconomic success. The averages of the “best studies” are somewhat higher than the averages of “all studies” indicating that the inclusion of the less appropriate samples among the latter lowers the meta-analytic results. It is surprising how much the number of samples (k) included among the “best studies” differs from the number of “all studies” — almost two thirds of the correlations with education had to be excluded for the analysis of the “best studies”. It shows that much of the research on intelligence and success is being conducted with samples that are either too old at the time of testing or too young at the measurement of success.

Having characterized the predictive power of intelligence in general, the next step is to compare it to the predictive power of parental SES and academic performance. Table 1 presents the meta-analytic results for the five indicators of parental SES (father’s education, mother’s education, father’s occupation, parental income, and the SES index). Not surprisingly, all the correlations are positive but, judging by the confidence intervals, several of the correlations (e.g., the one between father’s education and education, p=.50, or father’s occupation and occupation, p=.35) are significantly smaller than the respective correlations for intelligence. On the other hand, none of the parental variables is a significantly stronger predictor than intelligence. The SES index is the most successful predictor

[8] Note that these figures apply to the data sets that contain information on intelligence and success. Several additional data sets were used to obtain correlations between parental SES and success or between academic performance and success (see Appendix).

Table 1
Predictors of socioeconomic success

	k	N	r	rw	p	S.D.r	S.D.p	CV 95%	CI 95%
Correlation with education									
Intelligence (all studies)	59	84,828	.46	.48	.56	.12	.10	.36/.75	.53/.58
Intelligence (best studies)[a]	20	26,504	.49	.48	.56	.10	.07	.42/.69	.52/.59
Father's education	72	156,360	.40	.42	.50	.14	.13	.25/.75	.47/.53
Mother's education	57	141,216	.37	.40	.48	.13	.13	.22/.73	.44/.51
Father's occupation	55	147,090	.34	.35	.42	.09	.07	.27/.56	.40/.44
Parental income	13	64,165	.29	.31	.39	.10	.11	.17/.61	.33/.46
SES index	17	69,082	.41	.44	.55	.12	.10	.35/.75	.50/.60
Academic performance	27	49,646	.48	.47	.53	.09	.07	.39/.68	.50/.56
Correlation with occupation									
Intelligence (all studies)	45	72,290	.37	.36	.43	.13	.08	.28/.57	.40/.45
Intelligence (best studies)[a]	21	43,304	.41	.38	.45	.09	.05	.35/.54	.42/.47
Father's education	52	132,591	.27	.26	.31	.08	.06	.19/.43	.29/.33
Mother's education	40	116,998	.24	.23	.27	.08	.07	.13/.41	.25/.30
Father's occupation	57	146,343	.28	.29	.35	.10	.08	.19/.51	.33/.37
Parental income	12	60,735	.19	.21	.27	.07	.10	.07/.46	.21/.32
SES index	16	74,925	.30	.31	.38	.08	.08	.22/.54	.34/.42
Academic performance	17	54,049	.33	.33	.37	.09	.07	.23/.51	.33/.41
Correlation with income									
Intelligence (all studies)	31	58,758	.21	.16	.20	.09	.11	−.01/.40	.16/.23
Intelligence (best studies)[a]	15	29,152	.22	.19	.23	.08	.06	.10/.35	.19/.26
Father's education	45	107,312	.16	.14	.17	.09	.08	.01/.32	.14/.19
Mother's education	37	93,616	.13	.11	.13	.10	.07	.00/.27	.11/.16
Father's occupation	31	98,812	.16	.15	.19	.08	.10	.00/.38	.15/.22
Parental income	17	395,562	.16	.16	.20	.06	.07	.06/.33	.16/.23
SES index	14	64,711	.15	.14	.18	.07	.08	.03/.33	.14/.22
Academic performance	14	41,937	.11	.08	.09	.07	.08	−.07/.24	.04/.13

Note. *k* — number of independent samples, *N* — number of individuals, *r* — average correlation, rw — sample size weighted average correlation, *p* — sample size weighted average correlation corrected for unreliability and dichotomization, S.D.*r* — standard deviation of *r*, S.D.*p* — corrected standard deviation of *p*, CV 95%–95% credibility intervals of p, CI 95%–95% confidence intervals of *p*, SES — socioeconomic status.
[a]Best studies are the ones where intelligence is tested before the age of 19, and socioeconomic success is measured after the age of 29.

among the parental variables by not being a significantly weaker predictor than intelligence for any of the measures of success.[9]

The results for academic performance are presented in the last rows of the three sections of Table 1. The correlations of academic performance with education (p=.53) and occupation (p=.37) demonstrate that academic performance is an important predictor of educational and occupational success. The predictive power in relation to income, however, is weak (p=.09).

6.3. Moderator analysis using subgroups

As a first step in analyzing the influence of moderator variables, the analysis of subgroups was performed. The moderator variables were divided into the following categories: age at testing into 1–10, 11–15, 16–18, 19–25; age at success into 20–24, 25–29, 30–34, 35–39, 40–44, 45–49, and over 49; and the year of success into pre-1960, 1960–1969, 1970–1979, 1980–1989, post-1989. The raw data sets were exploited to the full extent by dividing the samples into appropriate subgroups by age or year. Every sample

[9] A reviewer suggested that a useful strategy for comparing the predictive power of two variables would be to look at the samples that provide information on both predictors and then make comparisons within each sample. The advantage of such within-sample comparisons would be the elimination of between-study methodological differences. I used this strategy to compare the correlations with intelligence and SES index (arguably the best measure of social background). The significance of the difference between the correlations was tested with the formula for comparing dependent correlations (Meng, Rosenthal, & Rubin, 1992: 173). With education as the measure of success, there were 15 samples that provided correlations with both IQ and SES index; in 11 of these samples, the correlations were significantly different (p<.05, 2-tailed); 8 of the significant differences were in favor of IQ. With occupation as the measure of success, 14 comparisons were made; 7 of the differences were significant, all in favor of IQ. With income as the measure of success, 12 comparisons were made; 5 were significant, 2 of them in favor of IQ. These results suggest that there seems to be an overall tendency for IQ to be a better predictor but this tendency is not consistently found in every occasion.

Table 2
Moderators of the correlation between intelligence and socioeconomic success

Moderators	Correlation with education				Correlation with occupation				Correlation with income			
	k	*N*	*r*	*p*	*k*	*N*	*r*	*p*	*k*	*N*	*r*	*p*
Age at testing												
3–10	12	16,330	.37	.42	12	15,083	.37	.35	8	13,614	.19	.20
11–15	26	26,208	.49	.57	16	13,711	.41	.45	6	9911	.23	.24
16–18	22	41,017	.51	.58	19	44,270	.40	.43	13	34,031	.17	.12
19–23	7	11,626	.51	.61	6	7855	.37	.47	7	13,177	.25	.33
Age at success												
20–24	28	50,080	.47	.57	16	41,359	.31	.35	10	30,979	.06	.01
25–29	23	44,253	.48	.57	22	43,559	.40	.44	20	44,521	.16	.20
30–34	14	22,102	.48	.58	15	28,674	.40	.45	16	31,297	.21	.27
35–39	9	13,199	.47	.55	11	13,442	.39	.45	9	8176	.25	.31
40–44	6	5250	.48	.55	8	14,815	.38	.45	7	11,000	.25	.23
45–49	6	4541	.43	.41	5	2036	.39	.46	5	1838	.21	.24
50–78	8	2826	.50	.58	7	5686	.44	.47	4	1137	.24	.25
Year of success												
1929–1959	6	3901	.53	.61	4	991	.48	.44	3	7192	.16	.24
1960–1969	17	28,642	.51	.57	12	23,795	.44	.43	7	11,189	.22	.28
1970–1979	18	30,882	.49	.57	13	24,671	.39	.42	11	17,189	.19	.11
1980–1989	17	27,313	.41	.54	17	24,004	.31	.45	12	25,834	.20	.14
1990–2003	13	28,763	.41	.56	13	38,889	.32	.41	11	31,655	.18	.22

Note. *k* — number of independent samples, *N* — number of individuals, *r* — average correlation, *p* — sample size weighted average correlation corrected for unreliability and dichotomization.

contributed only one correlation to a moderator category. If a sample could contribute more than one correlation, then the most appropriate of the available correlations (the one that best fitted into the moderator category) was used. Equally appropriate correlations were averaged.

Table 2 presents the results of the moderator analysis. The table is divided into three sections with every section presenting the results for one moderator variable. In the first section of Table 2, age at testing (i.e., mean age of the sample at the time of ability testing) is used as a moderator variable. The youngest sample in this analysis was, on average, 3 years old at the time of testing, the oldest one was 23 years old. The results of the analysis are quite clear-cut with regard to education and occupation as measures of success: the correlations increase as age at testing increases. The correlation between intelligence and income does not exhibit any obvious trend but even here the largest correlation comes from the oldest group.

In the next section of Table 2, the moderator variable is age at success (i.e., the mean age of the sample at the time of the measurement of socioeconomic success). Age at success ranges from 20 to 78 in the present study. The results are rather different for different measures of success. The correlation between intelligence and education remains more or less stable. The correlation between intelligence and occupation takes a noticeable upward leap during the twenties – from .35 in the 20–24 group to the .44 in the 25–29 group – and then levels off. The correlation between intelligence and income undergoes the most dramatic changes: the correlation is barely above zero in the 20–24 group but jumps to the value of .20 in the 25–29 group, and then takes another jump to the value of .27 in the 30–34 group; after the age of 40, the correlation appears to decline again but not as low as the values it had before the age of 30.

The influence of the third moderator variable, year of success (i.e., year of the measurement of success), is analyzed in the third section of Table 2. Year of success ranges from 1929 to 2003 in the present meta-analysis. Judging by the sample size weighted corrected correlations (*p*), there appears to be no historical trend for any one of the moderator variables: correlations with education and occupation remain more or less stable throughout the period under study; correlations with income fluctuate more but without any obvious direction. Quite surprisingly, if unweighted and uncorrected correlations (*r*) are observed instead, then the correlations with education and occupation exhibit a declining trend.

6.4. Moderator analysis using multiple regression

Moderator analyses in the previous section can be criticized for ignoring the fact that the moderator variables might not be completely independent of each other, which makes it possible to claim that some of the results can be explained by the intercorrelations among the moderator variables (Steel & Kammeyer-Mueller, 2002). In order to take account of this possibility, I conducted multiple linear regression analyses using the moderator variables as independent variables and the correlations between intelligence and measures of success as dependent variables. Such meta-regression analysis is a common meta-analytic tool (see Ganzeboom et al., 1989; Robbins et al., 2004).

The analyses that follow differ from the preceding moderator analyses in an important respect: in order to use all the available information, I gave up the requirement of independent data and included all the available correlations. If mental ability or socioeconomic success was measured repeatedly for the same sample, then all the correlations were included making it possible for one sample to contribute more than one correlation to the analysis.[10] Naturally, this strategy results in some samples providing much more correlations than others. In order to control for the effects of overrepresented samples, I constructed dummy variables for all the data sets that contributed more than 2 correlations from the same sample to a given moderator analysis. The dummy variables were inserted into regression models as independent variables. In some raw data sets that were large enough, the sample was broken down into smaller samples. For example, the National Longitudinal Survey of Young Women was divided into three subsamples according to the age at the start of the survey – the 14–17, 18–20, and 21–24 year olds – and these subsamples were then used as separate samples in the regression analyses. This was done to obtain samples that are more homogenous in terms of age and year and, thus, to better capture the effects of moderator variables.[11]

Table 3
Regression analyses of the impact of moderator variables on the correlation between intelligence and success

Independent variables	Dependent variables		
	Correlation between intelligence and...		
	Education	Occupation	Income
Age at testing	.49***	.35***	.39***
Age at success	−.11**	.56***	.40***
Year of success	.08*	−.54***	.10
U.S.A. dummy	−.05	−.18	−.16
Raw data dummy	−.23***	.31*	−.23
R^2 adjusted	.79	.47	.65
N	307	256	253

*$p<.05$, **$p<.01$, ***$p<.001$ (2-tailed).
Note. All the regression models include dummy variables for data sets that contribute more than 2 correlations from the same sample; coefficients are standardized regression coefficients; R^2 adjusted — explained variance, N — number of correlations in the analysis.

The results of the meta-regression analyses are presented in Table 3. There are three dependent variables in the table: the uncorrected correlations of intelligence with education, occupation, and income.[12] The independent variables are the three moderator variables (age at testing, age at success, and year of study) and data set dummies. In order to provide a rough control for possible international differences, I also included a dummy variable that equals 1 if the study was conducted in the United States. Furthermore, in order to control for possible methodological differences that might arise from using raw data (see Section 5.3), I constructed a dummy variable that equals 1 if the correlation was calculated from raw data. Following the suggestions made by Steel and Kammeyer-Mueller (2002), weighted least squares regression analysis was used: each correlation was weighted by the inverse of its sampling error variance as described in Steel and Kammeyer-Mueller (2002: 100–101).

[10] In order to understand the necessity of this methodological decision, consider the National Longitudinal Survey of Youth. This data set contains annual or biennial information on the career success of its respondents for a period of more than 20 years, thus providing an ideal opportunity to study age-related and historical changes in the relationship between intelligence and career. All this information would be lost, however, if only one correlation was allowed to represent one sample.

[11] There is, of course, a threat that breaking the original sample into smaller samples might limit the variance of the variables. But this is unlikely to be the case because all these newly created subsamples were large enough (sample size ranged from 126 to 4385 with a median of 503) to prevent any serious restriction of variance.

[12] It would make very little difference if *corrected* correlations (rather than uncorrected ones) were used in these analyses because almost all correlations would be corrected with the same reliability coefficients (see Section 5.3) and would, thus, be equally affected by the correction.

The results of the meta-regression analysis in Table 3 are not radically different from the results of the previous moderator analysis in Table 2. The moderating effect of age at testing is positive and significant in all the three regression models. Age at success has a positive effect on the correlations with occupation and income and a weak negative effect of the correlation with education. Year of success provides some surprises by having a weak positive effect of the correlation with education and a strong negative effect on the correlation with occupation. It is of interest that the U.S.A. dummy is not significant in any of the regression models indicating that the effect of IQ in the United States is similar to its effect in other western societies. The raw data dummy has a highly significant negative effect on the correlation with education and a barely significant positive effect on the correlation with occupation. Therefore, it seems that the inclusion of raw data is more likely to introduce a downward (rather than upward) bias into the meta-analysis thus making the results conservative.

7. Discussion

7.1. Intelligence as a predictor of socioeconomic success

Intelligence plays an influential and yet controversial role in people's career (Gottfredson, 1997). In order to investigate this role, the relationship between intelligence and socioeconomic success was analyzed using meta-analytic techniques. The first aim of the paper was to estimate the strength of this relationship. The overall correlations were .56 (between intelligence and education), .43 (between intelligence and occupation), and .20 (between intelligence and income). Exclusion of the samples that were too old (over 18) at the time of testing or too young (below 30) at the measurement of success resulted in somewhat larger correlations: .56, .45, and .23, respectively. These results demonstrate that intelligence, when it is measured before most individuals have finished their schooling, is a powerful predictor of career success 12 or more years later when most individuals have already entered stable careers. Two of the correlations – with education and occupation – are of substantial magnitude according to the usual standards of social science (Cohen, 1988); the correlation with education even surpasses the well-established correlation of .51 between intelligence and job performance (Schmidt & Hunter, 1998). The correlation with income is considerably lower, perhaps even disappointingly low, being about the average of the previous meta-analytic estimates (.15 by Bowles et al., 2001; and .27 by Ng et al., 2005). But it should be noted that other predictors, studied in this paper, are not doing any better in predicting income, which demonstrates that financial success is difficult to predict by any variable. This claim is further corroborated by the meta-analysis of Ng et al. (2005) where the best predictor of salary was educational level with a correlation of only .29. It should also be noted that the correlation of .23 is about the size of the average meta-analytic result in psychology (Hemphill, 2003) and cannot, therefore, be treated as insignificant.

The second aim of the meta-analysis was to compare the predictive power of intelligence to the predictive power of other prominent predictors of success, parental SES and academic performance. Such comparisons are informative because different predictors represent different paths to a successful career: intelligence represents one's general ability, parental SES represents the social advantages or disadvantages experienced by a person, and academic performance represents school-related learning and motivation. Meta-analysis demonstrated that parental SES and academic performance are indeed positively related to career success but the predictive power of these variables is not stronger than that of intelligence (see Table 1). In fact, intelligence exhibited several correlations with the measures of success that were larger than the respective correlations for other predictors suggesting that intelligence is, after all, a better predictor of success. Still, the differences in favor of intelligence were not as overwhelming as one would have expected based on the results of Herrnstein and Murray (1994). The index of parental SES, arguably the most representative measure of social background, did not differ significantly from intelligence in its predictive power (see Table 1). The same is true about the predictive power of academic performance in relation to education and occupation.

It has been observed before that meta-analyses typically do not provide support for extreme scientific positions (Lytton & Romney, 1991). This is also true in the present case because the extreme positions favoring intelligence (Herrnstein & Murray, 1994) or parental SES (Bowles & Gintis, 1976) were not supported by the results. The reasonable conclusion is rather modest: while intelligence is one of the central determinants of one's socioeconomic success, parental

SES and academic performance also play an important role in the process of status attainment. Despite the modest conclusion, these results are important because they falsify a claim often made by the critics of the “testing movement”: that the positive relationship between intelligence and success is just the effect of parental SES or academic performance influencing them both (see Bowles & Gintis, 1976; Fischer et al., 1996; McClelland, 1973). If the correlation between intelligence and success was a mere byproduct of the causal effect of parental SES or academic performance, then parental SES and academic performance should have outcompeted intelligence as predictors of success; but this was clearly not so. These results confirm that intelligence is an independent causal force among the determinants of success; in other words, the fact that intelligent people are successful is not completely explainable by the fact that intelligent people have wealthy parents and are doing better at school.

A number of moderator analyses of the intelligence–success correlation were also performed with the aim of further clarifying the relationship between intelligence and success. The effects of three moderator variables – age at testing, age at success, and year of success – were analyzed. With regard to age at testing, the results in Tables 2 and 3 clearly demonstrate that the test scores of older individuals are better predictors of success than the scores of younger individuals. As discussed in Section 4.3.1, there are two conflicting explanations for this result. On the one hand, if we assume that the test scores of older individuals are more “contaminated” by experiences, then this result suggests that experiences make a contribution to the correlation between intelligence and success. But on the other hand, if we assume that the test scores of older individuals are more “contaminated” by genetic influences, then it would mean that genes make a contribution to this correlation. Yet another explanation would be that IQ scores of children are simply less reliable and the predictive validity of childhood IQ was, therefore, underestimated. But contrary to this explanation, preliminary examination of some evidence on the stability of intelligence among children (e.g., Burchinal, Campbell, Bryant, Wasik, & Ramey, 1997; Jensen, 1980: 279) suggested that the test–retest coefficients among children below 10 are, on the whole, rather similar to the test–retest coefficients among older individuals. It appears that the age-related changes in the predictive validity of test scores cannot be explained by differential reliability of the scores.

Analyses of age at success in Tables 2 and 3 demonstrate that correlations with occupation and income grow stronger as individuals grow older. This result confirms the ideas of the gravitational hypothesis about intellectual differences cumulating throughout life course leading people increasingly towards the social positions that correspond to their ability (Gottfredson, 2003). The fact that declining validity hypothesis (Keil & Cortina, 2001) received no support for occupational and income attainment indicates that being successful in these areas is a complex activity that never ceases to be cognitively demanding. But as for educational attainment, the negative impact of age at success on the IQ-education correlation in Table 3 provides some support for the declining validity hypothesis and suggests that, in educational career, intellectual differences might indeed become somewhat less important as people get older. The difference between education and other measures of success can be explained by the fact that climbing the educational ladder is, in a sense, easier than climbing the occupational or financial ladder (because once you have acquired a certain level of education, you can never loose it again, which is clearly not the case with occupation or income).

Year of the measurement of success had no obvious effect on the corrected correlations (p) between intelligence and success in Table 2. The meta-regression analysis in Table 3 showed that there is a slight tendency for correlation between intelligence and education to increase over the years. This is the only bit of evidence there is to support the claims of Herrnstein and Murray (1994) about the growing importance of mental ability and increasing cognitive stratification. This evidence is rather weak in comparison with the much stronger declining trend exhibited by the correlation with occupation in Table 3. It would be difficult to come up with explanations why intelligence might have become more important with respect to one criterion and less important with respect to another. Therefore, the safest conclusion from Tables 2 and 3 seems to be that the correlation between intelligence and success has not changed in any consistent direction over the past decades. It should be noted that the present paper analyzed changes in the *absolute* importance of intelligence (measured by zero-order correlations); the results so far discussed do not exclude the possibility of growing *relative* importance of intelligence (i.e., importance relative to other predictors). However, the analyses of Bowles et al. (2001) and

Hauser and Huang (1997) found no evidence of any trend in the relative importance.

7.2. Possible limitations and implications for future research

Like all research, the present meta-analysis contains several limitations that can be amended in future research. One limitation concerns the meta-analytic database. Although the present meta-analysis is, to my knowledge, the most comprehensive review of the longitudinal research on intelligence and socioeconomic success, it does not cover all the existing data. I am aware of several additional longitudinal data sets that contain information on intelligence and success but from which I have been unable to obtain necessary data (see Jæger & Holm, 2003; Meghir & Palme, 2005; Nyborg & Jensen, 2001; Scarr & Weinberg, 1994). There are probably others. Efforts to collect information about the existing data sets should be continued. This applies especially to the data from outside the United States because U.S. data were clearly overrepresented in the present paper (see Section 6.1). Lack of data from continental Europe (e.g., Germany or France) demonstrates that intelligence as a scientific construct is primarily an Anglo-American invention and has not been very enthusiastically accepted in other scientific cultures. Of course, intelligence has been studied in continental Europe (see e.g., Flynn, 1987; Sternberg, 2004; Weinert & Schneider, 1999) but I have not been able to find suitable data for the present study.

The present study can also be criticized for underestimating the importance of the predictors of success; arguments can be offered for any of the three predictors (intelligence, parental SES, or academic performance) as to why their importance was underestimated. First, the present study used only three measures of social background (parental education, occupation, and income) and therefore, could have underestimated its importance. Although these three have always been the central indicators of social advantages, several additional measures of social background could have an independent effect on career success (Fischer et al., 1996). Future meta-analyses could, therefore, benefit from considering other variables, such as neighborhood quality (Leventhal & Brooks-Gunn, 2000), number of siblings (Blake, 1989), or parental divorce (Amato & Keith, 1991), to get a more comprehensive picture of the effects of social background. Second, the use of grade point average and class rank as the only measures of academic performance can be criticized for ignoring between-school differences; i.e., the same average grade or rank can have different meanings in different schools depending on the quality of the schools (Bassiri & Schulz, 2003). A more comprehensive study of the importance of academic performance should, therefore, also take account of the quality of the school the individual is attending. Third, as already discussed in Section 7.1, the predictive power of intelligence in younger samples could have been underestimated by using a single test–retest reliability coefficient for all studies that did not provide reliability coefficients of their own. Although it was concluded above that the underestimation was minimal, it would still be desirable to pay more attention to this problem in the future research.

As a possible limitation and implication for future research, it should also be noted that one of the big questions that looms behind every paper that deals with intelligence and success, the question of genetic versus environmental influences on IQ and social status, was not directly addressed in this paper. The fact that IQ scores predict socioeconomic success does not, in itself, tell us whether the effect of intelligence can be attributed to genes or environment. On the one hand, there is clear evidence that children's IQ scores are correlated with parental SES (White, 1982), this result together with the fact that parental SES predicts socioeconomic success (see Table 1) can be interpreted as showing that environment is the "final cause" of one's success or failure. This conclusion has been criticized for ignoring the genetic influences on parental SES (Jensen, 1998). On the other hand, the evidence on the heritability of intelligence (Devlin, Daniels, & Roeder, 1997) and socioeconomic success (Rowe, Vesterdal, & Rodgers, 1999) together with the evidence on the relationship between intelligence and success (see Table 1) can be taken as proof that parents' and children's social status are both determined by the genes for intelligence that run in the family. This conclusion has been challenged by Bowles and Gintis (2002) who argued that, although socioeconomic success might be heritable, the genetic inheritance of IQ, in particular, plays only a very minor part in this process. The results of the present meta-analysis, although not directly addressing these issues, can be useful in these discussions if combined with the results from other studies.

Appendix A

Data sets used in the meta-analysis

Data set[a]	Country	Source(s)[b]	Test(s)[c]	Correlation[d] between IQ and Education	Occupation	Income	Data on SES[e]	GPA[f]
Albany–Schenectady–Troy sample	U.S.A.	Lai, Lin, and Leung (1998)	–	–	–	–	Yes	No
Annual Twins Day sample	U.S.A.	Ashenfelter and Krueger (1994)	–	–	–	–	Yes	No
Australian sample, 1965	Australia	Lancaster Jones (1971)	–	–	–	–	Yes	No
Australian sample, 1967	Australia	Lancaster Jones (1971)	–	–	–	–	Yes	No
Australian sample, 1977								
Australians	Australia	Marjoribanks (1989)	Raven Progressive Matrices	.29	.28	–	No	No
Creeks	Australia	Marjoribanks (1989)	Raven Progressive Matrices	.39	.38	–	No	No
Italians	Australia	Marjoribanks (1989)	Raven Progressive Matrices	.53	.47	–	No	No
Baltimore Study	U.S.A.	raw data (www.pop.upenn.edu/baltimore)	Peabody Picture Vocabulary Test	.20	.13	.28	No	No
Berkley longitudinal studies								
All	U.S.A.	Elder (1974); Judge, Higgins, Thorensen, and Barrick (1999)	Stanford–Binet, Wechsler–Bellevue	–	.42	.31	No	No
Men	U.S.A.	Clausen (1991); Elder (1974)	Stanford–Binet, Wechsler–Bellevue	.53	–	–	No	No
Women	U.S.A.	Clausen (1991)	Stanford–Binet, Wechsler–Bellevue	.52	–	–	No	No
Bloomington sample								
1918 sample	U.S.A.	Ball (1938)	Mental Survey Test	–	.71	–	No	No
1923 sample	U.S.A.	Ball (1938)	Mental Survey Test	–	.57	–	No	No
British 1970 Cohort Study	U.K.	raw data (www.esds.ac.uk); Bynner (1970)	Human Figure Drawing + English Picture Vocabulary + Profile Test + Copying Design Test; British Ability Scales	.32	.28	.16	Yes	Yes
British sample, 1963	U.K.	Treiman and Terrell (1975a)	–	–	–	–	Yes	No
Canadian income tax data	Canada	Corak and Heisz (1999)	–	–	–	–	Yes	No
Canadian sample, 1975	Canada	Looker and Pineo (1983)	–	–	–	–	Yes	Yes
Christchurch Health and Development Study	New Zealand	Fergusson et al. (2005)	Wechsler Intelligence Scale for Children- Revised	.41	–	.12	No	No
Coleman's sample	U.S.A.	Marini (1984)	Standard Intelligence Scale	.51	–	–	Yes	Yes
Connecticut sample	U.S.A.	Rogers (1969)	several IQ tests	.53	–	.25	No	No
Core City sample	U.S.A.	Vaillant and Vaillant (1981), Long and Vaillant (1984)	Wechsler–Bellevue test	–	.34	.23	No	No
Dunedin Multidisciplinary Health and Development Study	New Zealand	Jaffee (2002)	Wechsler Intelligence Scale for Children- Revised	–	.41	–	No	No
European Social Survey, 2004	17 E.U. countries	raw data (www.europeansocialsurvey.org); Jowell and the Central Co-ordinating Team (2004)	–	–	–	–	Yes	No

Explorations in Equality of Opportunity	U.S.A.	Otto and Haller (1979)	Academic Aptitude test	.48	.35	.07	Yes	Yes
Fels Longitudinal Study								
Men	U.S.A.	McCall (1977)	Stanford–Binet; Wechsler–Bellevue; Primary Mental Abilities	.35	.38	–	Yes	No
Women	U.S.A.	McCall (1977)	Stanford–Binet; Wechsler–Bellevue; Primary Mental Abilities	.46	.49	–	Yes	No
Fort Wayne samples								
1963 seniors	U.S.A.	Kerckhoff (1974)	Lorge–Thorndike	.51	–	–	Yes	No
1969 9th graders, black	U.S.A.	Kerckhoff and Campbell (1977)	Lorge–Thorndike	.52	–	–	Yes	Yes
1969 9th graders, white	U.S.A.	Kerckhoff and Campbell (1977)	Lorge–Thorndike	.54	–	–	Yes	Yes
General Household Survey	U.K.	Psacharopoulos (1977)	–	–	–	–	Yes	No
General Social Survey	U.S.A.	raw data (www.norc.org/projects/gensoc.asp)	–	–	–	–	Yes	No
German Socio-Economic Panel	Germany	Couch and Dunn (1997)	–	–	–	–	Yes	No
Hawaii Family Study of Cognition								
European males	U.S.A.	Nagoshi, Johnson, and Honbo(1993)	15 tests of cognitive abilities	.31	.19	.35	No	No
European females	U.S.A.	Nagoshi et al. (1993)	15 tests of cognitive abilities	.34	.10	.21	No	No
Japanese males	U.S.A.	Nagoshi et al. (1993)	15 tests of cognitive abilities	.35	.25	.28	No	No
Japanese females	U.S.A.	Nagoshi et al. (1993)	15 tests of cognitive abilities	.37	.04	.16	No	No
High School and Beyond, sophmores	U.S.A.	Jencks and Phillips (1999), raw data (nces.ed.gov/surveys)	math + vocabulary + reading test	.55	.41	.09	Yes	Yes
Individual Development and Adaptation	Sweden	Kokko, Bergman, and Pulkkinen (2003)	–	–	–	–	No	Yes
Jyvaskyla Longitudinal Study	Finland	Kokko et al. (2003)	–	–	–	–	No	Yes
Kalamazoo brothers	U.S.A.	Jencks et al. (1979)	Terman, Otis	.58	.36	.37	Yes	No
Kalamazoo Fertility Study	U.S.A.	Bajema (1968)	Terman Group Intelligence Test	.58	.46	–	No	No
Lenawee County Survey	U.S.A.	Otto and Haller (1979)	Cattell IPAT Test	.42	.36	.18	Yes	Yes
Longitudinal Study of Labor Market Experience of Women	U.S.A.	Treiman and Terrell (1975b)	–	–	–	–	Yes	No
Malmö study	Sweden	Jencks et al. (1979)	Hallgren Goup Intelligence Test	.40	.42	.30	No	No
Minneapolis sample	U.S.A.	Benson (1942)	Haggerty Intelligence Examination	.57	–	–	No	No
Minnesota sample								
Fathers	U.S.A.	Waller (1971)	Otis, Kuhlmann	.71	.57	–	No	No
Sons	U.S.A.	Waller (1971)	Otis, Kuhlmann	.52	.50	–	Yes	No
Monitoring the Future project	U.S.A.	Schuster, O'Malley, Bachman, Johnston, and Schulenberg (2001)	–	–	–	–	No	Yes
NAS–NRC veteran twins sample	U.S.A.	Plassman et al. (1995)	Army General Classification Test	.56	–	–	No	No
National Child Development Study	U.K.	raw data (www.esds.ac.uk); City University. Social Statistics Research Unit	general ability test	.44	.38	.18	Yes	No
National Education Longitudinal Study	U.S.A.	raw data (nces.ed.gov/surveys)	–	–	–	–	Yes	Yes
National Longitudinal Survey of 1972 Class	U.S.A.	raw data (nces.ed.gov/surveys)	vocabulary + picture number + reading + letter groups + math + mosaic comparison	.48	.34	.04	Yes	Yes

(continued on next page)

Appendix A (*continued*)

Data set[a]	Country	Source(s)[b]	Test(s)[c]	Correlation[d] between IQ and Education	Occupation	Income	Data on SES[e]	GPA[f]
National Longitudinal Survey of Older Men	U.S.A.	Jencks et al. (1979)	–	–	–	–	Yes	No
National Longitudinal Survey of Young Men	U.S.A.	raw data (www.bls.gov/nls)	Otis, Beta, Gamma, California Test of Mental Maturity, Lorge–Thorndike, Henmon–Nelson, Test of Educational Ability, Primary Mental Ability Test, Differential Aptitude Test, School and College Ability Test	.52	.38	.09	Yes	Yes
National Longitudinal Survey of Young Women	U.S.A.	raw data (www.bls.gov/nls)	same as previous	.45	.38	.15	Yes	Yes
National Longitudinal Survey of Youth, 1979	U.S.A.	raw data (www.bls.gov/nls)	California Test of Mental Maturity, Otis–Lennon, Loge–Thorndike, Henmon–Nelson, Kuhlmann–Anderson, Differential Aptitude Test, School and College Ability Test, Stanford–Binet, Wechsler; Armed Forces Qualification Test	.54	.39	.24	Yes	No
National Longitudinal Survey of Youth, 1997	U.S.A.	raw data (www.bls.gov/nls)	Armed Services Vocational Aptitude Battery math-verbal score	.56	.24	.07	Yes	Yes
National Research Program of the Labor Market	Netherlands	De Graaf and Flap (1988)	–	–	–	–	Yes	No
National Survey of Health and Development	U.K.	Kerckhoff (1974); Kuh and Wadsworth (1991); Richards and Sacker (2003)	sentence completion + reading + vocabulary + picture intelligence; Alice Heim	.50	.41	.22	Yes	No
NBER Thorndike–Hagen sample	U.S.A.	Hause (1972)	17 tests of cognitive abilities	.26	–	–	No	No
Negotiating the Lifecourse Project	Australia	Jones and McMillan (2001)	–	–	–	–	Yes	No
Netherlands army sample	Netherlands	Vroon et al. (1986)	Raven Progressive Matrices	–	.42	–	No	No
New York State sample	U.S.A.	Kandel, Chen, and Gill (1995)	–	–	–	–	No	Yes
NLSY79 Child Surveys	U.S.A.	raw data (www.bls.gov/nls)	Digit Span + Peabody Picture Vocabulary Test	.40	.25	.14	Yes	Yes
NORC Brothers	U.S.A.	Jencks et al. (1979)	–	–	–	–	Yes	No
North Ireland sample	U.K.	Cassidy and Lynn (1991)	Differential Aptitude Test	.40	.24	–	Yes	No
Norwegian Twin Panel	Norway	Heath et al. (1985); Tambs, Sundet, Magnus, and Berg (1989)	general ability level	.53	.33	–	Yes	No
Occupational Changes in a Generation	U.S.A.	Jencks et al. (1979)	–	–	–	–	Yes	No
Occupational Changes in a Generation II	U.S.A.	Jencks et al. (1979)	–	–	–	–	Yes	No
Oxford Mobility Project	U.K.	Heath (1981)	–	–	–	–	Yes	No
Panel Study of Income Dynamics	U.S.A.	Couch and Dunn (1997); Jencks et al. (1979), Solon (1992), raw data (psidonline.isr.umich.edu)	Sentence Completion Test	.45	.27	.20	Yes	No

Parent–Child Project	U.S.A.	Englund, Luckner and Whaley (2003)	Wechsler Intelligence Scale for Children Revised	.33	–	–	No	No
Paths of a Generation	Estonia	raw data (psych.ut.ee/esta)	General Aptitude Test Battery	.46	.38	.20	Yes	Yes
Pennsylvania sample	U.S.A.	Chand, Crider and Willits (1983); Hanson (1983)	–	–	–	–	Yes	Yes
Perry Preschool project	U.S.A.	Luster and McAdoo (1996)	Stanford–Binet	.41	–	–	Yes	No
Philadelphia sample	U.S.A.	Thornberry and Farnworth (1982)	–	–	–	–	Yes	No
Poverty of the City of York	U.K.	Atkinson (1981)	–	–	–	–	Yes	No
Productive Americans	U.S.A.	Jencks et al. (1979)	–	–	–	–	Yes	No
Project Talent								
Brothers sample	U.S.A.	Jencks et al. (1979)	Academic Composite	.63	.48	.36	Yes	No
General sample	U.S.A.	Jencks et al. (1979); Jencks, Crouse and Mueser (1983); Porter (1974)	Academic Composite	.52	.40	.20	Yes	Yes
Twins sample	U.S.A.	Jencks et al. (1979)	Academic Composite	.62	–	–	No	No
Scottish Mental Surveys								
1921 cohort	U.K.	Bain et al. (2003); Deary et al. (2005)	Moray House Test	.24	.52	–	No	No
1936 cohort	U.K.	Hope (1983)	Terman–Merrill	.72	.64	–	No	No
Six City Survey of Labor Mobility	U.S.A.	Duncan and Hodge (1963)	–	–	–	–	Yes	No
Social Security earnings records	U.S.A.	Mazumder (2005)	–	–	–	–	Yes	No
Southern Regional Research Project	U.S.A.	Dyk and Wilson (1999); Wilson and Peterson (1993)	Otis–Lennon	.18	.17	–	Yes	Yes
Stockholm sample	Sweden	Gustaffson (1994)	–	–	–	–	Yes	No
Survey of Income and Program Participation	U.S.A.	Hauser, Warren, Huang, and Carter (2000)	–	–	–	–	Yes	No
Thorndike's study								
Boys age group	U.S.A.	Thorndike et al. (1934)	Thorndike–McCall Reading Test+ arithmetical problems	.54	–	–	No	Yes
Boys grade group	U.S.A.	Lorge (1945), Thorndike et al. (1934)	Thorndike–McCall Reading Test+ arithmetical problems	.39	–	–	No	Yes
Girls age group	U.S.A.	Thorndike et al. (1934)	Thorndike–McCall Reading Test+ arithmetical problems	.63	–	–	No	Yes
Girls grade group	U.S.A.	Thorndike et al. (1934)	Thorndike–McCall Reading Test+ arithmetical problems	.50	–	–	No	Yes
Toronto Metropolitan Area sample	Canada	Hagan, MacMillan, and Wheaton (1996)	–	–	–	–	Yes	No
Veterans of Korean War								
Black	U.S.A.	Brown and Reynolds (1975)	Armed Forces Qualification Test	–	–	.10	No	No
White	U.S.A.	Brown and Reynolds (1975)	Armed Forces Qualification Test	–	–	.31	No	No
Veterans sample	U.S.A.	Jencks et al. (1979)	Armed Forces Qualification Test	.55	.38	.35	Yes	No
West Coast high schools	U.S.A.	Spady (1970)	Primary Mental Abilities test	.40	–	–	Yes	Yes
White married women	U.S.A.	Scanzoni (1979)	–	–	–	–	Yes	No

(continued on next page)

Appendix A (*continued*)

Data set[a]	Country	Source(s)[b]	Test(s)[c]	Correlation[d] between IQ and			Data on	
				Education	Occupation	Income	SES[e]	GPA[f]
Wisconsin Longitudinal Survey								
Men	U.S.A.	Hauser et al. (1996), Otto and Haller (1979); Sewell et al. (1970); Sewell, Hauser, and Wolf (1980)	Henmon–Nelson	.48	.39	.16	Yes	Yes
Women	U.S.A.	Hauser et al. (1996), Sewell et al. (1980)	Henmon–Nelson	.35	.35	–	Yes	Yes
Wolfle–Smith sample	U.S.A.	Taubman and Wales (1974)	–	–	–	–	No	Yes
Youth in Transition, Australia	Australia	Marks and Fleming (1998)	–	–	–	–	Yes	No
Youth in Transition, U.S.A.	U.S.A.	Bachmann and O'Malley (1986)	Quick test + General Aptitude Test Battery + Gates test	.58	–	–	Yes	Yes

[a] If possible, the official title of the data set is given; if no official title was reported, the location or the name of the principal author is used to identify the data set.

[b] For several data sets, data were obtained from different sources; all the sources that provided correlations are listed in the Appendix. For every raw data set, a web site address is given where further information about the data is available.

[c] In several data sets, more than one test was used. The tests that were combined into a single measure of intelligence are separated by a plus sign (+); the tests that were administered to different portions of the sample are separated by a comma (,); the tests that were administered in different waves of the longitudinal survey are separated by a semicolon (;).

[d] The uncorrected correlations used in the analysis all studies (see Table 1) are reported in the Appendix. All the correlations reported in the Appendix (or anywhere in the text) were rounded to two decimal places; if more precise values were available, then these values were used in the calculations.

[e] This column indicates if the data set contributed correlations between parental SES and socioeconomic success.

[f] This column indicates if the data set contributed correlations between academic performance and socioeconomic success.

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