Effects of Sex, Race, Ethnicity and Marital Status on the Relationship between Intelligence and Fertility

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A negative relationship between intelligence and fertility in the United States has been described repeatedly, but little is known about the mechanisms that are responsible for this effect. Using data from the NLSY79, we investigate this issue separately for Blacks, non-Hispanic Whites and Hispanics. The major findings are: (1) Differential fertility would reduce the average IQ of the American population by up to 1.2 points per generation in the absence of migration and environmental changes; (2) About 0.4 points of the effect is caused by selection within racial and ethnic groups, and the rest is caused by between-group selection; (3) Differential fertility by intelligence is greatest in Hispanics and smallest in non-Hispanic Whites; (4) The fertility-reducing effect of intelligence is greater in females than males; (5) The IQ-fertility relationship is far stronger for unmarried than married people, especially females; (5) High intelligence does not reduce the desire for children; (6) High intelligence does not reduce the likelihood of marriage; (7) Education is the principal mediator of the IQ effect for married women.

Key Words: Intelligence; NLSY; Education; Fertility; Ethnicity; Race; Marriage; Dysgenics.

Children tend to be similar to their parents, both through cultural transmission in families and genetic inheritance. This similarity extends to personality traits and cognitive abilities that are important for people's functioning in society and that determine the "culture" of a nation or group. Therefore differential fertility influences *long-term* cultural trends on time scales ranging from one generation to many millennia, and the major rationale for the study of differential fertility is the prediction of long-term cultural trends.

There is substantial evidence that before the industrial

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revolution, the wealthier and socially successful sections of society had the highest reproductive rates. This has been demonstrated for preindustrial Europe (Clark & Hamilton, 2006; Hadeishi, 2003; Pettay et al., 2007; Stys, 1957/58), East Asia (Harrell, 1985; Lamson, 1935; Notestein, 1938), and diverse anthropological populations (Borgerhoff Mulder, 1987; Chagnon, 1980; Irons, 1980). The massive cultural and economic advances from the Middle Age toward the Industrial Revolution has been attributed to strong differential fertility favoring the wealthier classes in pre-industrial England (Clark, 2007).

However, since the early years of the 20th century, a negative relationship of fertility with social class has been a regular finding both in Britain (Notestein, 1936; Stevenson, 1920) and the United States (Kiser, 1932). These early observations were followed by studies showing that throughout the first half of the 20th century fertility was negatively related not only to measures of social class, but also to measures of intelligence (Anastasi, 1956; Cattell, 1936, 1937; Dawson, 1932/33), although atypical results were obtained occasionally (Willoughby & Coogan, 1940).

The baby boom years of the 1960s produced some studies reporting a negligible or even slightly positive relationship between intelligence and fertility in mainly white middle-class American samples (Bajema, 1963, 1968; Falek, 1971; Higgins et al., 1962; Waller, 1971). Even the subfertility of men in *Who's Who in America* seemed to disappear for cohorts born after 1910 (Kirk, 1957). The conclusion at the time was that dysgenic fertility had been a transient phenomenon of the demographic transition, when contraceptive habits were adopted by the educated classes before diffusing to the entire population. Neutral or mildly eugenic fertility was seen as the norm in mature post-transitional societies (Osborn & Bajema, 1972).

However, several studies in the United States during the last third of the 20th century again found the familiar negative relationship. Richard Udry (1978) observed a negative relationship between intelligence and fertility in a sample of married white women aged 15 to 44. Remarkably, some of this relationship persisted even when education and socioeconomic background were controlled.

A series of studies by Daniel Vining (1982, 1986, 1995) confirmed that dysgenic fertility had resumed among those born after 1935. Further evidence was produced by Retherford & Sewell (1988, 1989), who found a negative relationship between intelligence at age 17 and number of children at age 35 in a predominantly white sample in Wisconsin.

Additional evidence from the General Social Survey (van Court & Bean, 1985; Lynn & van Court, 2004) showed a negative relationship between a brief vocabulary test and number of children for cohorts spanning several decades. In the General Social Survey the relationship had been negative for all cohorts born after 1900, although it was weaker for those born 1920-1929. These studies found a more negative relationship for females than males, and those that included significant numbers of non-Whites found a more negative relationship for non-Whites than Whites. These results were obtained in the context of a persistent negative relationship between educational attainment and fertility (Retherford & Luther, 1996; Yang & Morgan, 2003)

Several explanations have been offered for the negative relationship between intelligence and fertility. Udry (1978) blamed the subfertility of more intelligent women on their more effective use of reversible contraceptives, whereas Retherford & Sewell (1989) found that the IQ effect was mediated almost entirely by education. In the General Social Survey, fertility is related more closely to education than to measured intelligence, and intelligence is only marginally predictive when education is held constant (Parker, 2004). However, in this case the only measure of intelligence was a 10-item vocabulary test, and years of schooling may simply be the better measure of intelligence.

The present study investigates the relationship between intelligence and number of children with data from the National Longitudinal Survey of Youth (NLSY). This survey contains sufficient numbers of Blacks, Whites, and Hispanics to permit separate analyses for these groups. There is also information about variables that could conceivably mediate effects of intelligence on reproduction.

One specific aim of the study is to determine the strength of the relationship between intelligence and number of children separately for males and females and for different ethnic/racial groups. A further aim is the investigation of possible mediating variables. We chose to investigate marital status, desired family size, educational attainment (highest grade and highest degree), family income, church attendance and gender attitudes as possible mediators of the intelligence effect. Specifically, we investigate the hypotheses that education mediates the intelligence effect; that intelligence reduces reproduction by reducing the desire for children; that high intelligence keeps people from marrying; and that the intelligence effect is mediated by low religiosity and/or liberal gender attitudes.

Data Sources and Methods

Data are from the NLSY79. This survey was launched in 1979 with 12,686 respondents. The composition of the sample was: 59.1% non-Hispanic White, 24.8% non-Hispanic Black, 12.9% Hispanic, and 3.1% others. Thus Blacks were oversampled nearly 3-fold relative to the US census population at that time, and Hispanics were slightly overrepresented as well. The following variables were extracted from the publicly available data:

IQ: The ASVAB (Armed Services Vocational Aptitude Battery) was administered in 1980, when subjects were between 15 and 23 years old. Slightly more than half of the respondents were still in school at that time. The 10 subtests of the ASVAB are science, arithmetic reasoning, word knowledge, paragraph comprehension, numerical operations, coding speed, auto & shop information, mathematics knowledge, mechanical comprehension and electronics information. Thus the ASVAB tests mainly acquired knowledge and skills ("crystallized intelligence"), although two subtests (numerical operations, coding speed) are tests of psychomotor speed.

Because performance on the ASVAB subtests rises linearly with age, and the rate of increase differs by gender and race (Meisenberg, 2009b), scores were age-adjusted and extrapolated to age 23 separately for the race-gender categories. The general ability factor (g-factor, or *g*) was extracted as the unrotated first principal component of the 10 age-adjusted ASVAB subtests. It was converted to the "IQ metric" by adjusting the mean for all 11,876 test-takers to 100 and the standard deviation to 15. Although it is derived as a latent factor rather than an averaged score, for simplicity we will refer to this measure as "IQ."

Children: This is the self-reported number of "children ever born" in 2004, when subjects were between 39 and 47 years old. This information was available for a total of 7661 respondents.

Desired children: Response to a question about the number of children the respondent "wants to have," asked in 1979.

Years married: Years spent in the married state up to age 39. Information about marital status was available for every other year, and each data point was assumed to represent two years of being either married or unmarried.

Education: Average of the standardized scores of highest grade completed by age 28 and highest degree at age 30.

lgIncome: log-transformed family income, average at age 28-37.

Religion: Frequency of religious attendance, average from 1979, 1982 and 2000, recorded on a six-point Likert scale from "not at all" to "more than once a week." Measures of religious belief are not available in the NLSY.

Gender attitudes: "Conservative" gender attitudes, defined as the first principal component from a two-factor varimax rotation of a set of 8 questions asked in 1979, 1982 and 1987. The four highest-loading items were "A woman's place is in the home, not in the office or shop;" "It is much better for everyone concerned if the man is the achiever outside the home and the woman takes care of the home and family;" "A wife who carries out her full family responsibilities has no time for outside employment;" and "Women are much happier if they stay at home and take care of their children."

Self-reported major racial/ethnic affiliation, asked in 1979, was used to define Hispanic ethnicity. The Hispanics included 112 Cubans, 66 Chicanos, 375 Mexicans, 671 Mexican-Americans, 308 Puerto Ricans and 108 "other Hispanics." Interviewer-recorded information about race (Black, White, and "other") was used to distinguish between Blacks and Whites. Hispanics were subtracted out of the black and white groups, and also some "Whites" who described their major origin as Japanese, Filipino or other Asian were excluded. The white group included 3.0% first-generation immigrants and 6.8% with at least one foreign-born parent. The respective numbers were 2.5% and 3.0% for Blacks, and 28.7% and 50.7% for Hispanics.

SPSS software was used for all analyses. Structural equation modeling was done with maximum likelihood estimation using AMOS.

Results

Overview of alternative predictors

Table 1 (below) shows the correlations between number of children and several predictors. Higher IQ is related to fewer children for black and Hispanic females and to a lesser extent for white females. In the male groups, only Hispanics have a substantial negative correlation. However, in all groups education (average of highest grade and highest degree) is even more predictive than IQ. This raises the possibility that the IQ effect is mediated by education.

Among the other predictors, the positive effect of marriage is greatest in Whites and smallest in Blacks, presumably because of different rates of nonmarital births in these groups. The effect of desired children is surprisingly weak. However, the question about desired family size had been asked in 1979, when the respondents were only 14 to 22 years old. Church attendance is associated with reproductive success in the white groups, but has the opposite effect in black females, presumably because of the high incidence of religiously disapproved nonmarital births in the latter group. "Conservative" gender attitudes tend to be associated with a greater number of children especially in females.

Table 1
Correlation (Pearson's *r*) of number of children with predictor variables. Education, composite of highest grade and highest degree; Religion, frequency of religious attendance; Gender attitudes, "conservative" attitudes; Des. children, number of desired children. * p<0.05; ** p<0.01; *** p<0.001.

	White Female (N = 1810)	Black Female (N = 1072)	Hispanic Female (N = 525)
IQ	-0.074**	-0.241***	-0.270***
Education	-0.146***	-0.333***	-0.358***
Religion	0.124***	-0.119***	0.022
Gender attitudes	0.152***	0.193***	0.279***
Years married	0.402***	0.129***	0.303***
Des. children	0.140***	0.034	0.069
	White Male (N = 1629)	**Black Male (N = 903)**	**Hispanic Male (N = 431)**
IQ	0.011	-0.004	-0.172***
Education	-0.028	-0.069*	-0.185***
Religion	0.120***	0.003	0.071
Gender attitudes	0.056*	0.050	0.187***
Years married	0.484***	0.199***	0.382***
Des. children	0.113***	0.016	0.122*

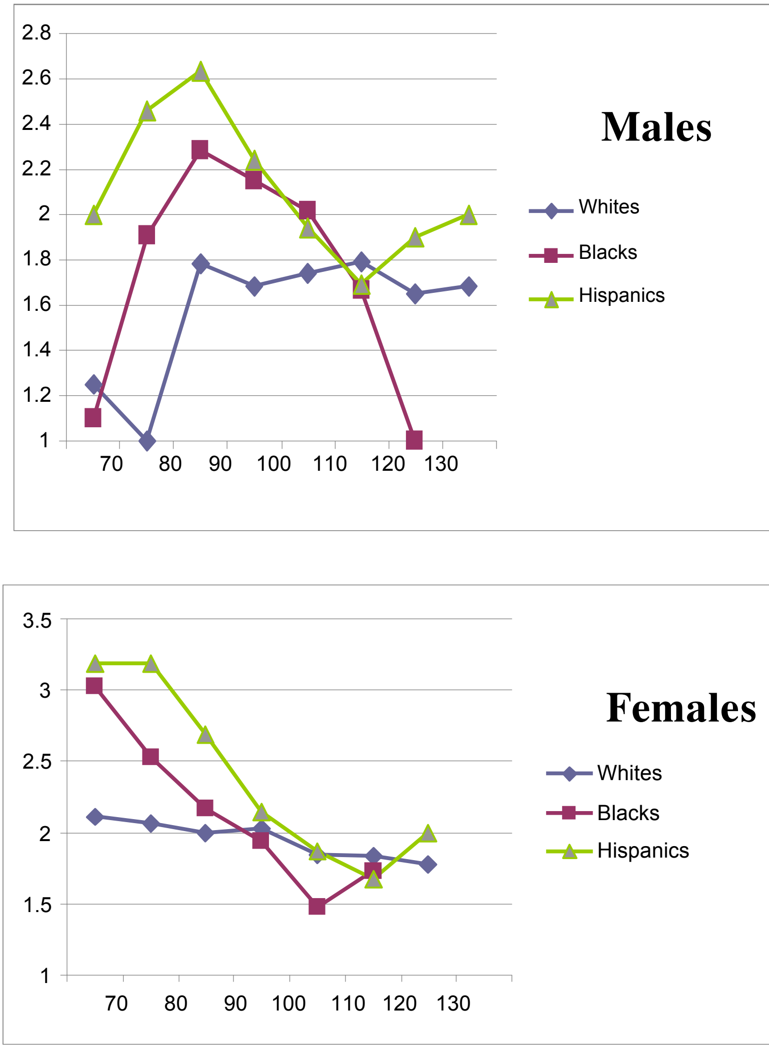

Figure 1
Number of children (y-axis) in relation to IQ (x-axis).

Figure 1 shows the relationships between intelligence and number of children graphically. In the male groups, very low IQs are associated with reduced reproductive success, and an IQ between 80 and 90 is optimal. In the female groups, however, IQs below 80 are most favorable for reproduction.

Extreme data points in Figure 1 need to be interpreted with caution because of small sample sizes. For example, only 9 black males, 2 Hispanic females and 22 Hispanic males had an IQ above 120; and only 9 white females, 4 white males and 13 Hispanic males had an IQ below 70.

Selection differential for intelligence

Differential fertility affects the phenotypic traits of the next generation simply because children are similar to their parents. The magnitude of this effect can be calculated based on the selection differential S:

$$S = \frac{1}{N} \sum_{i=1}^{n} \left(IQ_i - \overline{IQ} \right) \frac{CH_i}{\overline{CH}}$$

S = Selection differential

N = Number of cases

IQ_i = IQ of individual

$\overline{IQ}$ = Average IQ in sample

CH_i = Children of individual

$\overline{CH}$ = Average children in sample

The selection differential describes the phenotypes of individuals in the parental generation weighted for their reproductive rates. It is the extent to which the IQ would change in one generation if intelligence were determined only by additive genes and children had, on average, the same IQ as their parents.

Table 2
Selection differential (SD), average IQ and average number of children for different demographic groups. Values for the US population are calculated with a sample weight of 0.33 for Blacks.

	SD	IQ	Children	N
White	-0.373	107.5	1.81	3809
Black	-0.876	87.8	2.11	2227
Hispanic	-2.230	92.8	2.34	1128
Others	-1.000	98.1	1.89	201
US population	-1.620	101.7	1.98	5890

Table 2 shows the selection differentials separately for the demographic groups in the sample, together with their average IQ and number of children. The IQ of the white sample is well above 100 because we arbitrarily defined the average of the entire sample (without use of sample weights) as 100, and Blacks are oversampled in the NLSY.

The between-group IQ differences are rather large for at least three reasons. One is that non-Hispanic Whites and Hispanics are treated as separate categories. The second is that the reported IQs are adjusted IQs that are extrapolated to age 23 (see Methods section). Most of the reported results about racial IQ differences in the United States are from studies with children and young teenagers, but racial IQ differences are known to be substantially larger in young adults than in children and young teenagers both in the NLSY (Meisenberg, 2009b) and in other samples (Dickens & Flynn, 2006; Jensen, 1977).

Another reason for large between-group differences is the use of *g* (defined by principal components analysis) as a measure for "IQ." *g*-factor scores show somewhat larger between-group differences than IQs that are calculated as simple summary scores, presumably because *g* is a "purer" measure of intelligence (Jensen, 1985, 1998). It is also possible that to some extent the more disadvantaged sections of minority groups were oversampled in the NLSY.

In order to adjust for the 3-fold oversampling of Blacks, the selection differential for all groups combined (-1.62) is calculated by assigning a sample weight of one third to Blacks. Also the other data shown in Table 2 for the "US population" are weighted this way. With this sample weight applied, selection *within* groups contributes -0.814 points to the selection differential for the entire population. The remainder is selection *between* groups. Between-group selection is substantial because groups with higher IQ tend to have fewer children. In consequence, low-IQ groups increase in number while high-IQ groups diminish.

The selection differential is not a measure for the actual IQ change because not all of the IQ variance is explained by additive genes, and children do not have the same average IQ as their parents. Like other multifactorial traits, IQ shows regression to the population mean. The actual phenotypic change is approximated by the response to selection (R). It is defined as the product of selection differential and narrow-sense (additive) heritability h^2:

$$R = Sh^2$$

R is the actual phenotypic change that would be observed if environmental conditions were unchanged between generations. Assuming an h^2 of 0.5, the actual IQ *within* ethnic/racial groups would decline on average by about 0.4 points (0.5 x 0.814) in one generation.

The between-group component of the selection differential cannot be discounted by the heritability because h^2 applies only to differences between individuals. h^2 provides no information about the causes of differences between groups. If between-group differences are entirely environmental and environmental conditions change from generation to generation, group differences are expected to be unstable across generations and to have a tendency to disappear or reverse fast. In this case, nation-wide genetic selection is limited to the 0.4-point decline that is predicted by within-group selection. If, however, the between-group differences are entirely genetic, the between-group selection differential of about 0.8 need not be discounted at all, and the actual genetic decline in the US population is 1.2 IQ points per generation.

What we actually observe is that children regress not to the mean of the US census population, but to the mean of their own group (Osborne, 1980, p. 110). This is the reason why by-and-large, differences between ethnic and racial groups are maintained across generations.

The additive heritability of IQ scores and latent general factors of mental ability is somewhat debatable. Twin studies of adults and older adolescents typically produce *broad* heritabilities of about 0.7, meaning that about 70% of the variation within the studied population is accounted for by genes (Bouchard et al., 1990; Sundet et al., 1988). However, this includes not only additive gene effects but also nonadditive effects of unique gene combinations that are not reproduced in the offspring.

A study of the NLSY by Neiss et al. (2002) found an h^2 of 0.32 for scores on the AFQT (Armed Forces Qualification Test), which is computed from the arithmetic, word knowledge, paragraph comprehension and mathematics knowledge subtests of the ASVAB. The same study found an h^2 of 0.50 for education. However, these results are based on correlations between full-siblings and half-siblings. The reported heritabilities are lower-bound estimates because the study did not take account of assortative mating and misassigned paternity.

Several other studies found that values for parent-offspring regression for general intelligence are consistently near 0.5 (DeFries et al., 1976; Plomin & DeFries, 1980; Reed & Rich, 1982; Scarr & Weinberg, 1977; Vogler & DeVries, 1983; Williams, 1975). In other words, children are almost exactly half-way between their parents and the population mean. This might be an underestimate because these studies used summed scores rather than *g*. g-factor scores tend to be somewhat more heritable than summed scores (Jensen, 1998).

Both shared environment and additive genes contribute to parent-offspring resemblance. Shared environment is important for children and still accounts for 20% of the IQ variance at age 11 (Bartels et al., 2002; Castro et al., 1995), but its effect nearly vanishes by young adulthood (van der Sluis et al., 2008). Therefore parent-offspring regression between the ages of 15 and 23 is almost entirely due to shared genes, and we can adopt a value of 0.5 as our best estimate for the additive heritability h^2.

Earlier studies have not attempted to decompose genetic IQ selection effects in the United States into within-group and between-group components, but our result of between 0.4 and 1.2 points per generation is broadly similar to other reports from the late 20th-century United States which reported responses to selection amounting to -0.35 (Retherford & Sewell, 1988), -0.48 (Lynn, 1999), -0.5 (Vining, 1995), -0.8 (Loehlin, 1997) and -0.9 points (Lynn & Van Court, 2004).

Table 3
Correlation (Pearson's *r*) of number of children with ASVAB subtests for white females (WhF), white males (WhM), black females (BlF), black males (BlM), Hispanic females (HisF) and Hispanic males (HisM). * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

	WhF	WhM	BlF	BlM	HisF	HisM
Science	-0.062**	-0.022	-0.199***	-0.014	-0.014	-0.147**
Arithmetic	-0.044	0.021	-0.165***	-0.013	-0.013	-0.125**
Vocabulary	-0.090***	-0.019	-0.206***	-0.006	-0.305***	-0.151***
Comprehension	-0.052*	-0.001	-0.174***	-0.022	-0.305***	-0.159***
Numerical oper.	-0.036	0.032	-0.178***	0.062*	-0.197***	-0.058
Coding speed	0.005	0.033	-0.170***	0.045	-0.218***	-0.050
Auto & shop info	-0.040	0.035	-0.125***	0.044	-0.197***	-0.103*
Math knowledge	-0.058*	-0.005	-0.225***	-0.059	-0.245***	-0.154***
Mechanical comp.	-0.040	0.037	-0.064*	0.045	-0.194***	-0.116**
Electronics info	-0.055	-0.001	-0.096**	-0.013	-0.193***	-0.196***
IQ	**-0.063****	**0.012**	**-0.225*****	**0.006**	**-0.300*****	**-0.157*****
Correlation with *g*	-0.864**	-0.801**	-0.226	-0.727*	-0.521	-0.810**
N	1964	1845	1173	1054	600	528

Ability patterns

To describe the IQ effect more accurately, the number of children was correlated with the scores of each ASVAB subtest. Table 3 shows that in the female groups the negative relation of ASVAB subtests with the number of children is strongest for academic skills such as vocabulary, paragraph comprehension, science knowledge and mathematics knowledge. The relationships are weaker for tests of technical/vocational knowledge and for tests of psychomotor speed.

In the male groups, the relationship tends to be most negative for scholastic skills and most positive, or least negative, for speeded tests (numerical operations, coding speed). Table 3 also shows the relationship between a test's *g*-loading and its relationship with the number of children. The negative signs mean that in general, tests with higher g-loadings (e.g., science, vocabulary, arithmetic) reduce the number of children to a greater extent than do tests with low g-loadings (e.g., coding speed, auto & shop info, numerical operations).

Importance of marital status

Of all variables in Table 1, marital status has the strongest relationship with the number of children. This raises the possibility that more intelligent women have fewer children because they are less likely to marry. Table 4 compares those who had been married for at least 6 years with those who never married. The results confirm the importance of marriage for reproduction, at least for the white groups. However, the hypothesis that high intelligence deters people from marriage is clearly refuted. To the contrary, married black males, black females and white males have significantly higher IQs than those who never married.

If the negative relationship between IQ and reproduction cannot be explained by marriage rates, it must be due to fertility differentials within the married group and/or within the unmarried group. Having many children can make sense for married women, but is not always a smart choice for single women. Therefore we can expect that the negative relationship between IQ and reproduction is stronger for unmarried than married women.

Table 4
Differences between those who had been married for at least 6 years and those who never married. IQ - Children is the correlation (Pearson's *r*) between IQ and number of children. For IQ, significance levels are for comparisons with the corresponding married groups. ** p<.01; *** p<.001.

	Children	N	IQ	N	IQ - Children	N
White females, married	2.10	1596	104.5	1683	-0.033	1562
White females, single	0.58	172	103.9	179	-0.355***	168
White males, married	2.04	1396	111.7	1478	-0.010	1354
White males, single	0.33	232	107.9***	267	-0.128	225
Black females, married	2.34	508	88.4	540	-0.173***	497
Black females, single	1.90	412	85.4***	430	-0.339***	409
Black males, married	2.43	499	91.5	529	-0.072	487
Black males, single	1.56	351	85.8***	392	-0.039	336
Hispanic females, married	2.69	413	90.3	435	-0.248***	403
Hispanic females, single	1.51	83	89.6	86	-0.456**	81
Hispanic males, married	2.60	341	97.5	368	-0.240***	328
Hispanic males, single	1.05	103	95.8	116	-0.152	98

The last two columns in Table 4 confirm that this is indeed the case. Irrespective of race and ethnicity, unmarried women have a strongly negative relationship between IQ and number of children. Unmarried white and Hispanic males show a trend in the same direction. However, even married women have a negative relationship between IQ and number of children, except in the white group where the relationship is weak and fails to reach statistical significance.

Desire for children

The observation that the negative relationship with the number of children tends to be greatest for scholastic tests (Table 3) suggests that high intelligence reduces reproduction because intelligent people have intellectual interests that compete with interest in childrearing. This hypothesis predicts a negative relationship between IQ and the number of desired children.

However, Table 5 shows that the correlation between the number of desired children and the actual number of children is surprisingly low, even among those who had been married long enough to have their desired number of legitimate children. The likely reason is that the question about the number of desired children had been asked in 1979, when the respondents were only 14 to 22 years old. The last set of correlations in Table 5 shows that the relationship between IQ and desired family size is minimal in this age range. The only correlations that reach a conventional significance level are *positive* correlations between IQ and the number of desired children for black females and to some extent white females.

Comparison of alternative predictors

The regression models of Table 6 show the effects of multiple predictors on the number of children, separately by gender and marital status. Education is an important negative predictor for all groups except married males, and IQ is an independent predictor only for single females. This suggests that the negative effects of IQ are mediated mainly by education except for single women, whose reproduction is influenced more directly by intelligence. The results for the other predictors are congruent with the raw correlations in Table 1.

Table 6
Regression models predicting the number of children for married and single men and women. Shown are β-coefficient and significance level. * p<0.05; ** p < 0.01; *** p < 0.001.

	♀ Married	**♀ Single**	**♂ Married**	**♂ Single**
IQ	0.050	-0.210**	-0.042	0.014
Education	-0.154***	-0.150**	-0.008	-0.179**
lg Income	-0.032	-0.151**	-0.064*	-0.065
Religion	0.084***	-0.086*	0.100***	0.007
Gender attitudes	0.117***	0.076	0.036	0.048
Desired Children	0.126***	0.036	0.096***	0.031
Hispanic	0.120***	0.057	0.102***	0.129**
Black	0.073**	0.187***	0.054	0.334***
N	2286	565	1986	477
R^2	0.093	0.313	0.056	0.199

Table 7
IQ-children correlation, number of children, and IQ of Hispanics depending on acculturation. ** p < 0.01; *** p < 0.001.

	Children-IQ correlation	N	Children	N	IQ	N
Females						
All foreign-born	-.292***	152	2.74	160	82.8	192
All US-born	-.282***	448	2.40	465	92.5	565
US-born, 2 foreign-born parents	-.247***	65	1.97	67	96.0	82
US-born, 1 foreign-born parent	-.450***	71	2.43	72	94.7	90
US-born, no foreign-born parent	-.200***	301	2.47	315	91.4	380
Spanish spoken at home	-.297***	582	2.51	607	89.8	730
English spoken at home	-.070	18	1.83	18	96.8	27
Males						
All foreign-born	-.108	150	2.25	166	91.4	224
All US-born	-.181***	378	2.13	405	97.9	525
US-born, 2 foreign-born parents	.135	70	2.11	73	100.3	86
US-born, 1 foreign-born parent	-.148	71	2.10	73	99.1	90
US-born, no foreign-born parent	-.276***	227	2.14	248	97.3	335
Spanish spoken at home	-.151**	502	2.17	544	95.7	713
English spoken at home	-.248	26	2.00	27	102.1	36

Race and ethnicity have effects independent of the other predictors, indicating the importance of group-specific "cultural" effects. For example, everything else being equal, unmarried Blacks have more children than unmarried Whites, which are the comparison group for the Blacks and Hispanics in Table 6.

Acculturation and Hispanic fertility

Table 6 shows that the fertility of Hispanics (as well as Blacks) is higher than expected from the other predictors. This raises the possibility that high Hispanic fertility is a cultural trait of recent immigrants that is expected to disappear with acculturation to the English-speaking mainstream. Acculturation is often assumed to reduce fertility and raise the IQ of immigrants from less developed countries, and it might reduce the negative correlation between IQ and the number of children as well.

Table 7 shows that acculturation effects do occur but are of modest size and most evident for IQ. The IQ of US-born Hispanics is approximately 8 points higher than the IQ of foreign-born Hispanics. This means that the IQ gap between foreign-born Hispanics and non-Hispanic Whites shrinks by 38% for those Hispanics who were born in the United States. This difference is highly significant ($t = 10.6$, $p<.001$, $N = 1506$). However, when we limit the analysis to the US-born, we find that having US-born rather than foreign-born parents does not raise the IQ further. It actually lowers it significantly ($t = 4.07$, $p<.001$, $N = 1063$, males and females combined). Thus US-born Hispanics whose families have been residing in the United States for one or more generations have lower IQs than those with immigrant parents.

Fertility is slightly lower for the US-born than the foreign-born ($p = .024$, $N = 1196$ for males and females combined), which is congruent with their higher IQ. Considering only those born in the United States, increased length of the family's residence in the United States does not reduce the fertility any further. For females, an increasing number of US-born parents actually *raises* the fertility ($p = .026$, $N = 454$). The generally lower fertility of males than females in Table 7 can best be attributed to a high sex ratio among recent immigrants.

Also the correlation between IQ and number of children remains strongly negative for those born in the United States and those having one or two US-born parents. For males, the correlation even tends to become more negative with acculturation. Unfortunately the number of those who no longer speak Spanish at home is too small for meaningful analysis.

Path models

The relationships between intelligence and number of children were further investigated with path models. Figure 2 shows a model with education, log-transformed family income, religious attendance and "conservative" gender attitudes as possible mediators of the IQ effect. Tables 8 and 9 show the path coefficients and significance levels in this model for different demographic groups. Hispanic singles are omitted because their numbers were too small.

The models confirm a *direct* negative effect of IQ on the number of children for single but not married women. For all three groups of married women, education rather than intelligence is the major fertility-reducing factor. Even single males show a negative relationship between education and fertility.

High IQ is associated with more frequent religious attendance for the white groups, but not for Blacks and Hispanics. Religious attendance, in turn, is associated with higher fertility of married Whites but lower fertility of single black women. The latter is most likely related to religious disapproval of nonmarital births.

The correlated error between religious attendance and conservative gender attitudes represents an unmeasured "social conservatism" factor that is most important in the white population. As expected, conservative gender attitudes tend to increase female fertility. These attitudes are reduced by both intelligence and education.

Taken together, the path models in Tables 8 and 9 show that IQ has a direct effect in reducing the reproduction of unmarried women. In married women, however, the IQ effect is entirely indirect, being mediated mainly through education and to a lesser extent through liberal gender attitudes.

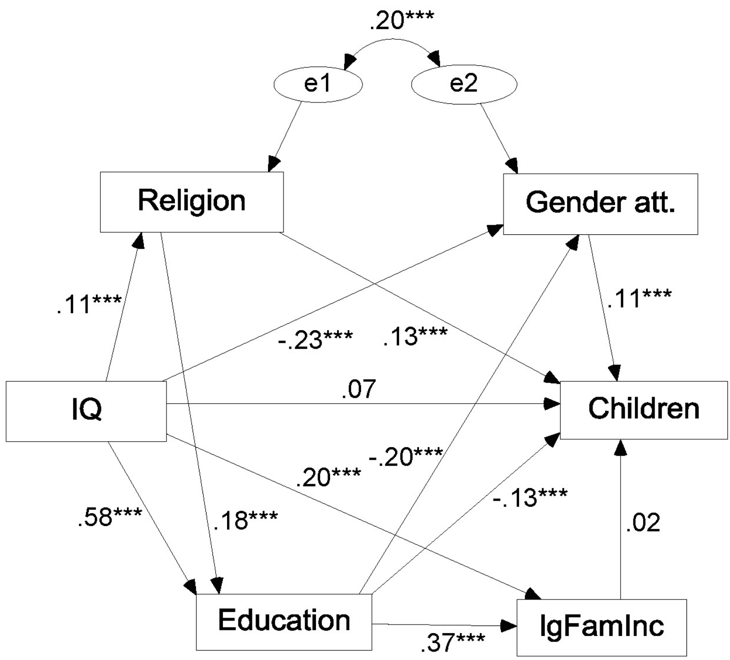

Figure 2:

Path model showing direct and indirect effects of IQ on the number of children for married white females. Religion is measured as religious attendance, and gender attitudes are measured as the endorsement of "conservative" gender roles. lgFamInc is log-transformed family income. Path coefficients and significance levels for the other demographic groups are summarized in Tables 8 and 9. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 8
Path coefficients for female groups in the model of Figure 2. df = 2. *, p<0.05; ** p<0.01; ***, p<0.001.

PATH	White Single Females	White Married Females	Black Single Females	Black Married Females	Hispanic Married Females
IQ → Education	0.591***	0.578***	0.673***	0.531***	0.700***
IQ → Income	0.195*	0.201***	0.188**	0.335***	0.180**
IQ → Religion	0.063	0.113***	0.084	0.053	-0.030
IQ → Gender Att.	-0.235*	-0.232***	-0.465***	-0.344***	-0.447***
Education → Income	0.429***	0.365***	0.366***	0.303***	0.445***
Education → Gender Att.	-0.227*	-0.199***	-0.147*	-0.208***	-0.222***
Religion → Education	0.245***	0.181***	0.183***	0.157***	0.120**
IQ → # Children	-0.276**	0.066	-0.159*	0.008	0.030
Education → # Children	-0.036	-0.134***	-0.198**	-0.175**	-0.271***
Income → # Children	-0.162	0.024	-0.074	-0.119*	-0.040
Religion → # Children	-0.089	0.134***	-0.099*	0.011	0.064
Gender Att. → # Children	0.121	0.113***	0.097	0.098	0.120
Religion ↔ Gender Att.	0.266**	0.199***	0.065	0.006	0.230***
N	147	1427	336	429	354
R^2	0.226	0.042	0.210	0.091	0.125
χ^2	3.00	10.4	4.19	3.56	8.39
RMSEA	0.059	0.054	0.057	0.043	0.095

Table 9
Path coefficients for male groups in the model of Figure 2. *** p<0.05; **, p<0.01; ***, P<0.001.

	White Single Males	White Married Males	Black Single Males	Black Married Males	Hispanic Married Males
IQ → Education	**0.597*** **	**0.576*** **	**0.439*** **	**0.586*** **	**0.629*** **
IQ → Income	**0.248** **	**0.203*** **	**0.280*** **	**0.226*** **	**0.231*** **
IQ → Religion	**0.068**	**0.238*** **	**0.059**	**0.017**	**0.009**
IQ → Gender Att.	**-0.118**	**-0.216*** **	**-0.339*** **	**-0.406**	**-0.320*** **
Education → Income	**0.256** **	**0.390*** **	**0.223** **	**0.348*** **	**0.406*** **
Education → Gender Att.	**-0.340*** **	**-0.254*** **	**-0.200** **	**-0.082**	**-0.153* **
Religion → Education	**0.219*** **	**0.176*** **	**0.241*** **	**0.135*** **	**0.117* **
IQ → # Children	**0.044**	**-0.024**	**0.050**	**0.006**	**-0.128**
Education → # Children	**-0.241* **	**-0.012**	**-0.167* **	**-0.058**	**0.012**
Income → # Children	**-0.010**	**-0.035**	**-0.118**	**-0.06**	**-0.143* **
Religion → # Children	**0.009**	**0.152*** **	**0.011**	**-0.002**	**0.083**
Gender → # Children	**0.102**	**0.016**	**0.028**	**0.076**	**0.109**
Religion ↔ Gender att.	**0.086**	**0.212*** **	**-0.051**	**0.122* **	**0.133* **
N	**177**	**1243**	**216**	**416**	**283**
R^2	**0.075**	**0.023**	**0.049**	**0.020**	**0.088**
χ^2	**0.02**	**8.85**	**0.51**	**3.84**	**0.34**
RMSEA	**0.000**	**0.053**	**0.000**	**0.047**	**0.000**

Discussion

The role of education

The results of this study both confirm and extend earlier findings. A negative relationship between IQ and fertility in the US population during the last quarter of the 20th century has been described by numerous earlier studies (Lynn, 1999; Lynn & van Court, 2004; Retherford & Sewell, 1988, 1989; Udry, 1978; van Court & Bean, 1985; Vining 1982, 1986, 1995). Most of these studies found a more negative relationship in females than males, and with one exception (Lynn, 1999), most of those that included non-white samples (Lynn & van Court, 2004; van Court & Bean, 1985; Vining, 1982, 1995) found the relationship more negative for non-Whites.

The present study confirms these earlier reports in showing a negative relationship between intelligence and fertility, a more negative relationship for females than males, and a more negative relationship for Blacks and Hispanics than non-Hispanic Whites.

It also confirms the earlier assertion (Parker, 2004; Retherford & Sewell, 1989) that education is the most important mediator of the IQ effect, at least for married women. The importance of education is shown both by regression models (Table 6), path models (Figure 2, Tables 8 and 9), and by the observation that tests of academic skills, rather than vocational ability or psychomotor speed, are the strongest predictors of a low birthrate (Table 3).

The path models show that education (as well as intelligence) can reduce fertility to some extent through the more liberal gender attitudes of educated and intelligent people. It is well known that intelligent people have more "liberal" attitudes on many issues (Deary et al., 2008).

The positive rather than negative relationship of religion with IQ (in Whites) and education (in all groups) may be surprising for some academics. However, earlier studies have shown that in the United States, education is related positively to religious attendance but negatively to traditional forms of religious belief (Glaeser & Sacerdote, 2008). Thus the relationships found in Figure 2 and Tables

8 and 9 do not necessarily mean that educated and intelligent people are more religious. They merely are more social. Interestingly, the positive relationship of religious attendance with reproduction is limited to white married males and females. It does not apply to other races and ethnicities, and does not explain the high Hispanic fertility (Tables 1, 8 and 9).

However, most of the education effect is not mediated by gender attitudes or religion. One clue to the possible mechanism is that in each of the six demographic groups, the fertility-reducing effect is greater for highest grade than for highest degree. For all groups combined the correlation with number of children is -0.146 for highest degree and -0.171 for highest grade N = 7039). This suggests that one mechanism is simply that time spent in school competes with time available for family formation.

An additional mechanism by which education (but not intelligence) reduces marital fertility is most likely the opportunity cost for educated women who have to choose between a lucrative career and family life, as has been shown in earlier work (e.g., Kemkes-Grottenthaler, 2003).

It might be argued that any relationship between intelligence and reproduction is irrelevant for the genetic transmission of intelligence because educational attainment rather than IQ is the most immediate predictor of reproductive success. However, individual differences in educational attainment are about as heritable as IQ in modern societies (Baker et al., 1996; Behrman & Taubman, 1989; Heath et al., 1985; Rowe et al., 1999; Vogler & Fulker, 1983). Also the fact that the ASVAB tests mainly acquired knowledge and skills, a.k.a. "crystallized intelligence," does not imply low heritability. School achievement tests have the same high heritability as IQ tests (Bartels et al., 2002; Friend et al., 2009; Petrill & Wilkerson, 2000; Reynolds et al., 1996; Wainwright et al., 2005), presumably because both types of test measure mainly genetically based learning ability.

The role of marriage and desire for children

The hypothesis that high intelligence makes people uninterested in family life is clearly refuted by the facts.

Table 4 shows that among black males and females and among white males, those who have been married for at least 6 years have higher IQs than those who never married. In regression models with IQ and education as joint predictors of the time spent in the married state up to age 39, high IQ *increases* the likelihood of marriage for all black and white groups ($p<0.001$ in each case), but not Hispanics. Independent of IQ, education reduces the marriage rate for non-Hispanic white men and women although it raises it for black men ($p<0.001$ in each case, data not shown).

These results can be compared with an earlier report from an Afro-Caribbean population that found an independent positive effect of IQ (but not education) on the likelihood of being married (Meisenberg et al., 2006). In the Caribbean study the IQ was measured in older people, but in the NLSY the test was administered before the subjects got married. Therefore it appears that, at least in these African-descended populations, high pre-existing intelligence raises the likelihood of marrying rather than married life raising the IQ.

Thus we can safely dispense with the hypothesis that high intelligence reduces fertility by making people averse to marriage. High education can have this effect, at least in Whites, but the effect of high IQ is in the opposite direction.

The hypothesis that high intelligence reduces the desire for children is refuted by the results presented in Table 5. One caveat is that the question was asked when the respondents were between the ages of 14 and 22 years, *before* most of them had started their reproductive careers.

Table 4 shows that dysgenic fertility for IQ is far greater for unmarried than married people, with the only exception of black males. This is an important finding because it shows that dysgenic fertility for intelligence in the late 20^{th} century United States was caused not only by the detrimental effect of education on female fertility. It was caused also by the rising proportion of children who were born to single mothers. The greater dysgenic fertility of Blacks relative to non-Hispanic Whites is explained in large part by the greater proportion of nonmarital births in this group. We predict that future studies will generally find greater dysgenic fertility for intelligence in populations with a high proportion of single mothers, compared to populations in which the large majority of children are raised by both parents.

For unmarried women, the effect of IQ on reproduction is not mediated entirely by education. This is somewhat surprising because for young women a nonmarital birth can be a reason for school dropout. Therefore we have to expect a negative relationship between education and nonmarital fertility that is independent of IQ. The results presented in Tables 4 and 8 strongly suggest that low intelligence itself can raise the fertility of single women directly, independent of years in school or educational degrees.

Disparities between black and white Americans

One major concern is that dysgenic fertility for IQ and education tends to be greater for those groups that already have lower average IQs, and that between-group differences will increase as a result. One important reason for the greater dysgenic fertility of low-IQ groups is their higher proportion of nonmarital births.

Another likely reason is a less efficient use of reversible contraceptives by some members of these groups, as proposed by Udry (1978). This may no longer be important in high-IQ groups where even the least proficient individuals are effective contraceptors, as proposed by Osborn & Bajema (1972). However, it may still be important for low-IQ groups and for groups with cultural reservations against contraception. We can only speculate that the latter factor might play a role for the strongly dysgenic fertility of Hispanics.

Greater dysgenic fertility in low-IQ groups is expected to widen the existing IQ gaps between racial and ethnic groups, but the magnitude of this effect is small. The IQ gap between Blacks and non-Hispanic Whites is expected to grow by 0.25 IQ points in one generation because the selection differential is 0.5 points greater in Blacks (Table 2), and the response to selection is estimated as 50% of the selection differential.

Factors other than differential fertility have far larger effects on this time scale. According to one estimate the black-white IQ gap has diminished by 4 to 7 points between 1972 and 2002 (Dickens & Flynn, 2006), although this conclusion has been contested (Murray, 2006; Rushton & Jensen, 2006). Some narrowing of the IQ gap seems to have occurred among those born between the late 1950s and the early 1970s (Murray, 2007). Gaps on scholastic achievement tests narrowed for these same birth cohorts by as much as 40%. However, ethnic and racial gaps on scholastic achievement tests remained remarkably constant or even widened slightly for those born after the early 1970s (Chay et al., 2009; Hedges & Nowell, 1999; National Science Foundation, 2003; Neal, 2006).

Test score trends of this magnitude and on this time scale are of environmental origin and can be caused or reversed by educational and other interventions. A biological way to offset the predicted widening of the black-white gap by 0.25 points in one generation (about 28 years) is interbreeding. "Blacks" In the United States already have about 25% European genes (Chakraborty et al., 1992), and mulattoes (including even Obama!) are socially classified as "black."

The predicted widening of the gap by 0.25 points per generation that is produced by current fertility patterns can be neutralized if approximately 3.3% of the "black" children in the next generation have one white parent. This assumes an otherwise stable Black/White IQ difference of 15 points and an average IQ of 100 for the interbreeding Whites.

Actually, according to census data from the Public Use Microdata Sample of 1990, at that time 6.3% of married black men under the age of 30 were married to a white woman, and 2.5% of married black women were married to a white man (Heaton & Albrecht, 1996). By 2000, 14% of married African American men and 5% of married African-American women aged 10-34 were married to a person of a different race (Qian & Lichter, 2007). Data about the fertility of interracial marriages and about the percentage of mixed-race parentage among illegitimate children do not seem to be available.

Those Whites who marry a black partner are not markedly different from other Whites in education and income. Most intermarriage occurs at fairly high educational levels (Heaton & Albrecht, 1996; Gullickson, 2006), but it is doubtful that this is also the case for nonmarital fertility.

Thus we can conclude that since the late 20th century, greater dysgenic fertility of Blacks is more than compensated for by continued interbreeding with the white population. On balance, Black-White IQ differences are predicted to decrease slowly, but disparities within the nominally black population will rise, especially because poorly educated Blacks are effectively excluded from the interracial marriage market (Gullickson, 2006). Thus the interracial marriage patterns, combined with strong dysgenic fertility, virtually guarantee the persistence of a black underclass, while educated African-Americans are absorbed into the white/Asian/interracial middle class.

Hispanic trend lines

Hispanics illustrate the effect of acculturation on intelligence. Table 7 shows that being born in the United States raises the Hispanic IQ by about 8 points (males and females combined), compared to those born abroad. US-born Hispanics with two foreign-born parents outscore the foreign-born by an even wider margin of approximately 11 points. These differences can be attributed to environmental factors.

A more surprising observation is that those with two foreign-born parents score higher than those with one foreign-born parent, who in turn score higher than those with two US-born parents. Thus we find an apparent *negative* acculturation effect for US-born Hispanics! Being born and raised in the United States gives a strong boost to the IQs of Hispanic children relative to children who were born abroad, but beyond this initial effect, increased length of the family's residence in the United States does not have any further effect!

One possible explanation for the negative acculturation effect is that Hispanic immigration had become more selective in the years prior to the 1970s. Another possibility is that the more proficient sections of the Hispanic population assimilate into the non-Hispanic mainstream in every generation, leaving a residual of less educable and poorly assimilable individuals to form a visible "disadvantaged" Hispanic minority.

However, the latter effect appears to be small. Only 51 out of 1640 respondents in the NLSY who listed a Hispanic group as their "first/only racial/ethnic origin" indicated a "2nd racial/ethnic origin" other than Hispanic, and 99 respondents who are classified as "non-Hispanic Whites" list a Hispanic group as their 2nd racial/ethnic origin.

Finally, strong dysgenic fertility in the United States is expected to make a modest contribution to the lower IQs of those Hispanics whose families have resided in the United States for at least one generation. The effect is predicted to be about 1.1 IQ points per generation when Hispanics with different lengths of residence in the United States are compared (50% of the selection differential in Table 2). However, this calculation makes the unrealistic assumption that dysgenic fertility starts with immigration into the United States, rather than being present in the countries of origin as well.

Thus the best reading of the evidence is that as in the case of African Americans, strong dysgenic fertility for intelligence and education is important for the perpetuation of a visible "disadvantaged" Hispanic minority.

Consequences for the United States

If we assume that today's racial and ethnic IQ differences in the United States are entirely of environmental origin and will therefore dissipate within one generation, the average IQ in the United States is predicted to decline by only 0.4 points in one generation. This is the predicted response to selection *within* ethnic and racial groups.

However, if we assume that the between-group differences are genetic and that therefore the magnitude of the IQ and achievement differences between groups remains constant, we must add the between-group selection differential of 0.8 points to this figure. In this case the total predicted decline is 1.2 points. Given the experience of stable group differences for cohorts born after the early 1970s, the latter calculation is more realistic. The large role of between-group selection is plausible if we remember that non-Hispanic Whites are expected to become a minority in the United States shortly before 2050. For children under the age of 18, this point will be reached around 2025 (Pollard & O'Hare, 1999).

The assumption that the causes of between-group differences are genetic is debatable. Nevertheless, as long as between-group differences do not change substantially, the IQ is expected to decline by approximately 1.2 points in a single generation as a result of differential fertility. This is very little compared to the Flynn effect, which raised the average IQ in the United States (and elsewhere) by nearly 10 points per generation during most of the 20th century (Flynn, 1987; Flynn & Weiss, 2007).

The Flynn effect was caused by improved environmental conditions. Environmental conditions, in turn, improved because people used their higher intelligence to improve the conditions of life. Therefore the dynamic nature of modern civilization has been attributed to a positive reinforcement between rising intelligence and the improvements of environmental conditions that are brought about by intelligent action and that raise human intelligence even more (Meisenberg, 2007, pp. 277-78).

However, the Flynn effect is grinding to a screeching halt in Europe (Flynn, 2009; Raven, 2008, Figs. 8.6 and 8.7; Shayer et al., 2007; Shayer & Ginsburg, 2009; Sundet et al., 2004; Teasdale & Owen, 2008), Australia (Cotton et al., 2005), and possibly the United States (Rodgers & Wänström, 2007; Beaujean & Osterlind, 2008).

The Flynn effect was most likely caused by the massive expansion of formal education during the 20th century (Goldin & Katz, 1999; Husén & Tuijnman, 1991; Meyer et al., 1977, 1992; Schofer & Meyer, 2005), combined with other environmental improvements including better nutrition and medical care (Lynn, 1990). Today, even further improvements of these environmental factors are hard to achieve and people in advanced societies seem to be approaching the genetic limits for the development of their intelligence. Without a continuing Flynn effect, IQ trends in advanced societies will be small during the 21st century, and a significant portion of the remaining trends will be caused by differential fertility.

In the United States, the predicted IQ decline can be compensated for by immigration. A predicted decline of 1.2 IQ points per generation can be neutralized by admitting, for example, immigrants with average IQs of 120 from countries with average IQs of 100 in numbers corresponding to 10.7% of the (next-generation) US population. This calculation takes account of the 50% regression to the population mean that is expected for the children of these immigrants.

The international context

Reduced fertility of individuals and groups with high intelligence and/or education is not limited to the United States. It is part of a worldwide pattern that has been shown to occur among individuals within countries worldwide (Meisenberg, 2008; Weinberger, 1987), in comparisons between countries (Lynn & Harvey, 2008; Meisenberg, 2009a) and, in the United States, in comparisons between states (Shatz, 2008). The negative correlation between education and fertility is stronger in the less developed countries than in the most advanced societies (Meisenberg, 2008). This pattern resembles the finding in the United States of a more negative relationship in groups with lower average IQ and education.

In less developed countries, the effects of adverse fertility patterns are still masked by the Flynn effect. Rising intelligence has been reported from several of these countries including Kenya (Daley et al., 2003), Dominica (Meisenberg et al., 2005), Brazil (Colom et al., 2006) and Sudan (Khaleefa et al. 2008, 2009). This trend is likely to continue through most of the 21st century in the wake of mass education and rising prosperity.

Nevertheless, the worldwide resources of talent are not inexhaustible. In the short term, the immigration of highly qualified individuals can counteract the effects of adverse fertility differentials in the United States and other advanced societies. A necessary consequence is that brain drain will leave the less attractive and less developed countries without the human capital they need for their economic and social advancement. Economic, cognitive and cultural disparities between countries will fail to disappear. Because the effects of differential fertility are cumulative over generations, terminal decline and collapse of even the most advanced societies are therefore predictable if current fertility patterns persist indefinitely (Meisenberg, 2007, pp. 325-345).

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