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Intelligence and childlessness

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ABSTRACT

Demographers debate why people have children in advanced industrial societies where children are net economic costs. From an evolutionary perspective, however, the important question is why some individuals choose not to have children. Recent theoretical developments in evolutionary psychology suggest that more intelligent individuals may be more likely to prefer to remain childless than less intelligent individuals. Analyses of the National Child Development Study show that more intelligent men and women express preference to remain childless early in their reproductive careers, but only more intelligent women (not more intelligent men) are more likely to remain childless by the end of their reproductive careers. Controlling for education and earnings does not at all attenuate the association between childhood general intelligence and lifetime childlessness among women. One-standard-deviation increase in childhood general intelligence (15 IQ points) decreases women's odds of parenthood by 21–25%. Because women have a greater impact on the average intelligence of future generations, the dysgenic fertility among women is predicted to lead to a decline in the average intelligence of the population in advanced industrial nations.

1. Introduction

Demographers have long debated why people have children, especially in advanced industrial societies where children are net economic costs (Friedman et al., 1994; Schoen et al., 1997). Among others, the question is key to understanding the causes of the fertility decline universally observed in such societies (Davis et al., 1987).

Explanations for parenthood and fertility decline range from normative (Blake, 1968; Lesthaeghe, 1983; Preston, 1986; Ryder, 1979; Westoff, 1986), to cultural or religious (Hayford and Morgan, 2008; Heaton, 1986; Mosher et al., 1992; Pearce, 2002; Westoff and Bumpass, 1973), and to rational choice (Becker, 1960, 1981; Butz and Ward, 1979; Easterlin et al., 1980; Friedman et al., 1994; Schoen et al., 1997). Empirically, we know that individuals' desire for and intentions about children strongly influence their actual fertility behavior (Barber, 2001; Williams et al., 1999); quite unsurprisingly, individuals who want to have children are more likely to have them than those who do not. But we do not know *why* some people want to have children more than others (Hayford, 2009, p. 767).

From an evolutionary perspective, however, *why people have children is the wrong question to ask.* Humans, like all other species in nature, are evolutionarily designed to reproduce. It is therefore not at all theoretically problematic that most individuals choose to have children in their lifetimes, even when they represent net economic costs. Humans have children because they are evolutionarily designed to do so. Reproduction is the ultimate (albeit largely unconscious) goal of all

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biological existence, including humans, and everything else, like money and wealth, is a means to it. The theoretical puzzle from this perspective is *why some individuals choose not to have children despite their biological design.*

A leading evolutionary explanation for fertility decline in industrial societies is the trade-off theory (Beauchamp, 1994; Kaplan et al., 2002). The theory proposes that parents maximize their reproductive success by maximizing the joint product of the quantity and quality of offspring. For any given level of parental resources, the fewer children they have, the more they can invest in each. Since industrial societies require that the parents invest heavily in each child, they are forced to have fewer children, hence the fertility decline after industrialization.

A recent empirical test in the Netherlands (Kaptijn et al., 2010), however, does not support the trade-off theory. While the number of children in the family is negatively associated with their quality, measured by sex-specific mate value (the fewer children parents have, the higher the mate value of each child), there is also a negative association between the children's mate value and their fertility. In other words, taken altogether, parents who have fewer children end up with fewer grandchildren than those who have more children. Thus any tendency to limit the number of children in order to increase their quality cannot evolve. Perhaps this result could have been predicted from the earlier behavior genetic finding that fertility is partly heritable (Kohler et al., 1999; Rodgers et al., 2001). The fewer children you have, the fewer children your children are genetically predisposed to have.

In this paper, I propose a new evolutionary psychological explanation for why some individuals desire to have children more than others. The theory predicts that more intelligent individuals are less likely to value parenthood and more likely to choose to remain childless. Analyses of a prospectively longitudinal, large, nationally representative sample from the United Kingdom show that more intelligent men and women are more likely, early in their reproductive careers, to express a desire to remain childless for life. However, only more intelligent women (not more intelligent men) are actually more likely to remain childless for life.

2. Evolutionary origins of individual preferences and values

Where do individuals' preferences and values, such as values for or against children, come from? Why do people like or want what they do? The origin of individual preferences and values is one of the remaining theoretical puzzles in social and behavioral sciences (Kanazawa, 2001).

Recent theoretical developments in evolutionary psychology may suggest one possible explanation (Kanazawa, 2010b). On the one hand, evolutionary psychology (Crawford, 1993; Symons, 1990; Tooby and Cosmides, 1990) posits that the human brain, just like any other organ of any other species, is designed for and adapted to the conditions of the ancestral environment (roughly the African savanna during the Pleistocene Epoch), not necessarily to those of the current environment. It may therefore have difficulty comprehending and dealing with entities and situations that did not exist in the ancestral environment (Kanazawa, 2002, 2004a). On the other hand, an evolutionary psychological theory of the evolution of general intelligence proposes that general intelligence may have evolved as a domain-specific adaptation to solve evolutionarily novel problems, for which there are no predesigned psychological adaptations (Kanazawa, 2004b, 2008).

The logical conjunction of these two theories, *the Savanna-IQ Interaction Hypothesis* (Kanazawa, 2010a), implies that the human brain's difficulty with evolutionarily novel stimuli may interact with general intelligence, such that more intelligent individuals have less difficulty with such stimuli than less intelligent individuals. In contrast, general intelligence may not affect individuals' ability to comprehend and deal with evolutionarily familiar entities and situations.

Evolutionarily novel entities that more intelligent individuals are better able to comprehend and deal with may include ideas and lifestyles, which form the basis of their preferences and values; it would be difficult for individuals to prefer or value something that they cannot truly comprehend. Hence, applied to the domain of preferences and values, the Hypothesis suggests that more intelligent individuals are more likely to acquire and espouse evolutionarily novel preferences and values that did not exist in the ancestral environment than less intelligent individuals, but general intelligence has no effect on the acquisition and espousal of evolutionarily familiar preferences and values that existed in the ancestral environment (Kanazawa, 2010b).

There has been emerging evidence for the Hypothesis as an explanation for individual preferences and values. First, more intelligent children are more likely to grow up to espouse left-wing liberalism (Deary et al., 2008; Kanazawa, 2010a), possibly because genuine concerns with genetically unrelated others and willingness to contribute private resources for the welfare of such others – liberalism – may be evolutionarily novel. Even though past studies show that women are more liberal than men (Lake and Breglio, 1992; Shapiro and Mahajan, 1986; Wirls, 1986), and blacks are more liberal than whites (Kluegel and Smith, 1986; Sundquist, 1983), the effect of childhood intelligence on adult liberalism is twice as large as the effect of sex or race (Kanazawa, 2010a).

Second, more intelligent children are more likely to grow up to be atheists (Kanazawa, 2010a), possibly because belief in higher powers, as a consequence of overinference of agency behind otherwise natural phenomena, may be part of evolved human nature (Atran, 2002; Boyer, 2001; Guthrie, 1993; Haselton and Nettle, 2006; Kirkpatrick, 2005), and atheism may therefore be evolutionarily novel. Even though past studies show that women are much more religious than men (Miller and Hoffmann, 1995; Miller and Stark, 2002), the effect of childhood intelligence on adult religiosity is twice as large as that of sex (Kanazawa, 2010a).

Third, more intelligent boys (but not more intelligent girls) are more likely to grow up to value sexual exclusivity (Kanazawa, 2010a), possibly because humans were naturally polygynous throughout evolutionary history (Alexander et al., 1979; Harvey and Bennett, 1985; Kanazawa and Novak, 2005; Leutenegger and Kelly, 1977; Pickford, 1986). Either under monogamy or polygyny, women are expected to be sexually exclusive to one mate; in sharp contrast, men in polygynous marriage are not expected to be sexually exclusive to one mate whereas men in monogamous marriage are. So the expectation of sexual exclusivity may be evolutionarily novel for men, but not for women.

Fourth, more intelligent children are more likely to grow up to be nocturnal, going to bed and waking up later (Kanazawa and Perina, 2009), possibly because nocturnal life was rare in the ancestral environment where our ancestors did not have artificial sources of illumination until the domestication of fire. Ethnographies of contemporary hunter-gatherers suggest that our ancestors may have woken up shortly before dawn and gone to sleep shortly after dusk. Night life may therefore be evolutionarily novel.

Fifth, the human consumption of psychoactive substances, such as alcohol, tobacco, and drugs, is evolutionarily novel, all originating less than 10,000 years ago. Thus the Hypothesis would predict that more intelligent individuals are more likely to consume alcohol, tobacco, and drugs. The analyses of two prospectively longitudinal data sets with nationally representative samples in the UK and the US support the prediction. More intelligent individuals consume more alcohol more frequently, smoke more tobacco (but only in the US), and use more illegal drugs (Kanazawa and Hellberg, 2010). More intelligent individuals are more likely to engage in binge drinking and get drunk (Kanazawa, 2012, pp. 163–167).

Finally, criminals on average have lower intelligence than the general population (Wilson and Herrnstein, 1985; Herrnstein and Murray, 1994). This is consistent with the Hypothesis because, while much of what we call interpersonal crime today is evolutionarily familiar, the institutions that control, detect, and punish such behavior are evolutionarily novel (Kanazawa, 2009). Murder, assault, robbery and theft were probably routine means of intrasexual male competition for resources and mates in the ancestral environment. We may infer this from the fact that behavior that would be classified as criminal if engaged in by humans is quite common among other species (Ellis, 1998), including other primates (de Waal, 1989, 1992; de Waal et al., 1993). It also explains the "exception that proves the rule," why more intelligent individuals are more likely to consume illegal drugs (Kanazawa and Hellberg, 2010). Unlike most interpersonal and property crimes, the consumption of such substances is evolutionarily novel. It is not legality per se that matters, but evolutionary novelty of the behavior.

There was very little formal third-party enforcement of norms in the ancestral environment, only second-party enforcement (retaliation by victims and their kin and allies) or informal third-party enforcement (ostracism). It therefore makes sense from the perspective of the Hypothesis that men with low intelligence may be more likely to resort to evolutionarily familiar means of competition for resources (theft rather than full-time employment) and mating opportunities (rape rather than computer dating) and not to comprehend fully the consequences of criminal behavior imposed by evolutionarily novel entities of law enforcement.

It is important to emphasize that the Hypothesis predicts that more intelligent individuals are more likely to acquire and espouse *evolutionarily novel* preferences and values, not necessarily more adaptive (or more desirable, or better or "smarter") ones. In fact, many of the evolutionarily novel preferences and values espoused by more intelligent individuals are often maladaptive in the context of the current environment (Kanazawa, 2012). It is very important to keep this theoretical point in mind, as voluntary childlessness as an evolutionarily novel value is by biological definition highly maladaptive.

3. Voluntary childlessness as an evolutionarily novel value

If any value is deeply evolutionarily familiar, it is reproductive success. All living organisms, including humans, are evolutionarily designed to reproduce; reproductive success is the ultimate end of all biological existence. While having children is not the only means to increase inclusive fitness (representation of one's genes in the next generation), as it could be achieved by investment in close genetic relatives, it is nonetheless the primary means of maximizing reproductive success. None of us are descended from ancestors who remained childless, and we are disproportionately descended from individuals who achieved disproportionate reproductive success.

Having children, and having as many children as one can potentially raise to sexual maturity so that the children themselves can reproduce, is an evolutionarily familiar goal. In contrast, voluntary childlessness is evolutionarily novel. The Hypothesis would therefore predict that more intelligent individuals are more likely to express an evolutionarily novel value for voluntary childlessness than less intelligent individuals. Given that individuals in advanced industrial nations have reasonable control over their fertility, and thus the ability to implement their values for or against children successfully, the Hypothesis would also predict that more intelligent individuals are more likely to remain childlessness than less intelligent individuals.

There have been numerous studies that establish the negative association between intelligence and fertility or parenthood. Maxwell (1969) shows that childhood intelligence is negatively associated with the number of children for both men and women in the 1932 and 1947 Scottish Mental Surveys. Lynn and Van Court (2004) establish a negative association between verbal intelligence and the number of children in representative samples of Americans in the General Social Surveys. However, education is not controlled in either of these studies, so it is not clear whether it is intelligence itself or its correlate, education, that decreases fertility. It is well known that education is negatively associated with fertility (Musick et al., 2009; Rindfuss et al., 1996).

In their analysis of the Wisconsin Longitudinal Study, Retherford and Sewell (1988, 1989) show that childhood intelligence, measured in 11th grade, decreases fertility, measured at 35. Their analysis further shows that the effect of intelligence on fertility is larger for women than for men, and that it is *entirely* mediated by education. Net of education, childhood intelligence does *not* affect completed fertility in their analysis. Similarly, Meisenberg (2010; Meisenberg and Kaul 2010) shows that, net of education, childhood intelligence has no independent effect on the number of children (except for white males) in the National Longitudinal Survey of Youth 1979. Rodgers et al. (2008) show that intelligence net of education has no effect on age at first birth among female Danish twins in the Middle-Aged Danish Twin survey, and Neiss et al. (2002) reach a similar conclusion in their behavior genetic analysis of the National Longitudinal Survey of Youth 1979. Reeve et al. (2013) show that both intelligence and education have independent effects on parenthood in the Project TALENT data, but education has a much stronger effect than intelligence for both men and women. Finally, Chen et al. (2013) show that intelligence does not at all mediate the effect of education on fertility among Taiwanese women, while there is no association between intelligence or education and fertility among men.

In this paper I will attempt to replicate these findings on the association between intelligence, education and fertility with a large, nationally representative, and prospectively longitudinal sample from the United Kingdom. I will examine the effect of childhood intelligence on individuals' preference for parenthood early in their reproductive careers and their completed fertility (lifetime parenthood or childlessness) at the end of their reproductive careers in their late 40s. It is important to note that the Hypothesis is about the effect of general intelligence on evolutionarily novel preferences and values, such as voluntary childlessness. Therefore, contrary to findings by Retherford and Sewell (1988, 1989), Meisenberg (2010; Meisenberg and Kaul 2010), Reeve et al. (2013) and Chen et al. (2013), I do *not* expect education to mediate the effect of general intelligence on lifetime parenthood at all.

4. Empirical analyses

4.1. Data

The National Child Development Study (NCDS) is a large-scale prospectively longitudinal study which has followed a *population* of British respondents since birth for more than half a century. The study includes *all* babies (n = 17,419) born in Great Britain (England, Wales, and Scotland) during one week (03–09 March 1958). The respondents are subsequently reinterviewed in 1965 (Sweep 1 at 7; n = 15,496), in 1969 (Sweep 2 at 11; n = 18,285), in 1974 (Sweep 3 at 16; n = 14,469), in 1981 (Sweep 4 at 23; n = 12,537), in 1991 (Sweep 5 at 33; n = 11,469), in 1999–2000 (Sweep 6 at 41–42; n = 11,419), and in 2004–2005 (Sweep 7 at 46–47; n = 9534). There are more respondents in Sweep 2 than in the original sample (Sweep 0) because the Sweep 2 sample includes eligible children who were in the country in 1969 but not when Sweep 0 interviews were conducted in 1958. In each Sweep, personal interviews and questionnaires are administered to the respondents, to their mothers, teachers, and doctors during childhood, and to their spouses and children in adulthood.

Virtually all (97.8%) of the NCDS respondents are Caucasian. There are so few respondents in other racial categories that, if I control for race with a series of dummies in generalized linear models, it often results in complete separation of data, and the maximum likelihood estimation becomes impossible. I therefore do not control for respondents' race in my analysis of the NCDS data. The appendix table presents the means, standard deviations, and a full correlation matrix for all the variables (described below) that are used in my logistic regression analyses, separately by sex.

4.2. Dependent variable: preference for parenthood

At 23, NCDS respondents indicate if they intend to have any children. Their response is coded 0 if they intend to remain childless and 1 if they intend to have children. If the respondents already have children before 23, they automatically receive the value of 1 for preference for parenthood. However, excluding those who already have children before 23 and limiting the analyses to those who are childless at 23 does not at all alter any of the substantive conclusions presented below. The NCDS does not ask respondents' fertility intentions after 23. I analyze the dichotomous variable with binary logistic regression.

4.3. Dependent variable: lifetime parenthood

At 47, NCDS respondents indicate whether they have had any biological children in their lives. From this I create a binary dependent variable for lifetime parenthood, which is 0 if the respondent has remained childless for life and 1 if the respondent has had any children in their lives.

Fielder and Huber (2007) show that 99.7% of women and 96.5% of men in a representative Swedish sample have completed their lifetime reproduction by 45. I may therefore reasonably assume that the NCDS respondents have largely (if not entirely) completed their lifetime reproduction by 47.

4.4. Independent variable: General intelligence

The NCDS respondents take multiple intelligence tests at 7, 11, and 16. At 7, the respondents take four cognitive tests (Copying Designs Test, Draw-a-Man Test, Southgate Group Reading Test, and Problem Arithmetic Test). At 11, they take five cognitive tests (Verbal General Ability Test, Nonverbal General Ability Test, Reading Comprehension Test, Mathematical Test, and Copying Designs Test). At 16, they take two cognitive tests (Reading Comprehension Test, and Mathematics Comprehension Test). I first perform a factor analysis at each age to compute their general intelligence score for each age. All cognitive test scores at each age load only on one latent factor, with reasonably high factor loadings (Age 7: Copying Designs Test = .671, Draw-a-Man Test = .696, Southgate Group Reading Test = .780, and Problem Arithmetic Test = .762; Age 11: Verbal General Ability Test = .920, Nonverbal General Ability Test = .885, Reading Comprehension Test = .864, Mathematical Test = .903, and Copying Designs Test = .486; Age 16: Reading Comprehension Test = .909, and Mathematics Comprehension Test = .909). The latent general intelligence scores at each age are converted into the standard IQ metric, with a mean of 100 and a standard deviation of 15. Then, I perform a second-order factor analysis with the IQ scores at three different ages to compute the overall childhood general intelligence score. The three IQ scores load only on one latest factor with very high factor loadings (Age 7 = .867; Age 11 = .947; Age 16 = .919). I use the childhood general intelligence score in the standard IQ metric as my main independent variable.

4.5. Control variables

4.5.1. Education at 23

In order to separate the effect of childhood intelligence from that of education, I control for the respondent's education at the beginning of reproductive career at 23. Due to a highly complex system of examinations, qualifications, and certifications in the British school system, education in NCDS is measured qualitatively by a five-point ordinal scale: 0 = no qualification; 1 = CSE 2–5/NVQ 1; 2 = O levels/NVQ2; 3 = A levels/NVQ 3; 4 = higher qualification/NVQ 4; 5 = degree/NVQ 5–6.

4.5.2. Earnings at 23

I control for the respondent's earnings at 23. Earnings are measured as net annual pay of current job in GBP1K. Respondents who are not in the labor force are included in the sample and given the earnings of 0.[1] Only 9.1% of the NCDS respondents went to universities (Education = 5), and even they would have completed their formal education by Age 21, as universities are only for three years in England and Wales. Very few would still be in full-time education at Age 23.

I choose to measure earnings at 23, near the beginning of the respondents' reproductive careers, in order to avoid the problem of endogeneity. Earnings later in life, especially for women, may be endogenous to, and partially influenced by, the respondents' reproductive behavior earlier in their lives. As it turns out, however, it does not much matter when the earnings are measured, because earnings at 23 is significantly positively correlated with earnings at 33 ($r = .052$, $p < .001$), at 42 ($r = .093$, $p < .001$), and at 47 ($p < .095$, $p < .001$). These correlations are surprisingly small, but it is *not* because the Age 23 measure is taken very early in the respondents' careers or because of the long time interval. The correlation between Age 42 and 47 measures is equally small ($r = .071$, $p < .001$) and that between Age 33 and 42 measures is not even statistically significant ($r = .019$, *ns*).[2]

4.5.3. Religiosity at 23

I control for the respondent's religiosity at 23 by the frequency of church attendance: 0 = no religion; 1 = rarely or never; 2 = less than monthly; 3 = monthly or more; 4 = weekly or more.

4.5.4. Lifetime number of marriages

Because marriage is often (though not always) a precondition for parenthood, I control for the lifetime number of times that the respondent has been legally married before 47.

4.5.5. Social class of family of orientation

I control for the respondent's social class in the family of orientation with three separate measures: Father's social class at birth (0 = unemployed, dead, retired, no father present, 1 = unskilled, 2 = semiskilled, 3 = skilled, 4 = white-collar, 5 = professional); mother's education; and father's education (both measured as the age at which the parent left full-time education). Mother's education and father's education are measured at 16.

[1] Excluding respondents not in the labor force at 23 and limiting the analyses to only those with some earnings at 23 does not alter the results for either desire for parenthood at 23 or lifetime parenthood, except to reduce the significance of the effect of childhood general intelligence on lifetime parenthood for women slightly, from $p = .038$ to $p = .059$.

[2] If I substitute mean lifetime earnings (an arithmetic mean of earnings measured at 23, 33, 42, and 47) for earnings at 23, none of the results for desire for children (presented in Table 1 below) changes. For lifetime parenthood, among women, the negative effect of childhood general intelligence is no longer statistically significant, while the mean lifetime earnings has a significantly negative effect. However, this is no doubt largely due to the fact that childless women can devote more of their time and energy throughout their lives to their careers than women with children can. Among men, the positive effect of childhood intelligence becomes statistically significant, while mean lifetime earnings does not have a significant effect.

4.5.6. Number of siblings

Since there is some evidence that the number of children one has is partly heritable and genetically influenced (Kohler et al., 1999; Rodgers et al., 2001), I control for the number of siblings the respondent has, as an indicator of the respondent's parents' fertility. Number of siblings is measured at 16. All of the substantive conclusions from the logistic regression analyses below remain the same if I measure the number of siblings dichotomously as whether the respondent is an only child or has siblings.

5. Results

Table 1 presents the results of the binary logistic regression analysis of preference for parenthood at 23. Columns (1) and (4) show that, consistent with the prediction of the Hypothesis, childhood general intelligence is significantly negatively associated with preference for parenthood both among women and men. Fig. 1 shows that women who intend to become parents have a mean childhood IQ of 99.94 whereas women who intend to remain childless for life have a mean childhood IQ of 105.50 ($t = 7.173$, $df = 3544$, $p < .001$). Similarly, men who intend to become parents have a mean childhood IQ of 100.02 whereas men who intend to remain childless for life have a mean childhood IQ of 104.35 ($t = 5.310$, $df = 3439$, $p < .001$). The standardized coefficients on odds in Table 1, Columns (1) and (4), suggest that one standard deviation increase in childhood general intelligence (15 IQ points) decreases the odds of preference for parenthood by 35% among women and by 27% among men. More intelligent boys and girls are indeed more likely to acquire and espouse the evolutionarily novel preference of voluntary childlessness in early adulthood.

Table 1, Columns (2) and (5), show that controlling for education does not at all attenuate the negative association between childhood general intelligence and desire for parenthood at 23, while education itself, net of childhood general intelligence, is not significantly associated with desire for parenthood at 23. However, once I further control for earnings, religiosity, social class at birth, number of siblings, mother's education and father's education, childhood general intelligence

Table 1
The effect of general intelligence on desire for children at age 23, National Child Development Study (1958–2005).

	Women			Men		
	(1)	(2)	(3)	(4)	(5)	(6)
Childhood IQ	−.029***	−.023***	−.017	−.020***	−.018**	−.007
	(.004)	(.006)	(.009)	(.004)	(.006)	(.009)
	.655	*.715*	*.780*	*.735*	*.758*	*.898*
Education at 23		−.085	−.018		−.062	−.136
		(.057)	(.088)		(.062)	(.093)
		.885	*.975*		*.916*	*.825*
Earnings at 23			−.323***			.149**
			(.061)			(.045)
			.574			*1.411*
Religiosity at 23			.249**			.221*
			(.087)			(.106)
			1.334			*1.266*
Family of orientation						
Social class at birth			.033			−.137
			(.108)			*(.114)*
			1.035			*.869*
Number of siblings at 16			.039			.077
			(.061)			(.063)
			1.074			*1.153*
Mother's education			.074			−.069
			(.081)			(.085)
			1.109			*.911*
Father's education			−.055			.020
			(.066)			(.075)
			.914			*1.033*
Intercept	5.099	4.746	4.148	4.153	4.170	2.952
	(.433)	(.577)	(.848)	(.401)	(.559)	(.820)
χ^2 (df = 1/2/8)	52.757***	37.303***	58.537***	28.734***	21.307***	29.807***
Number of cases	3546	2777	1458	3441	2505	1243

Note: Main entries are unstandardized regression coefficients.
Numbers in parentheses are standard errors.
Italicized numbers are standardized effects on odds.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

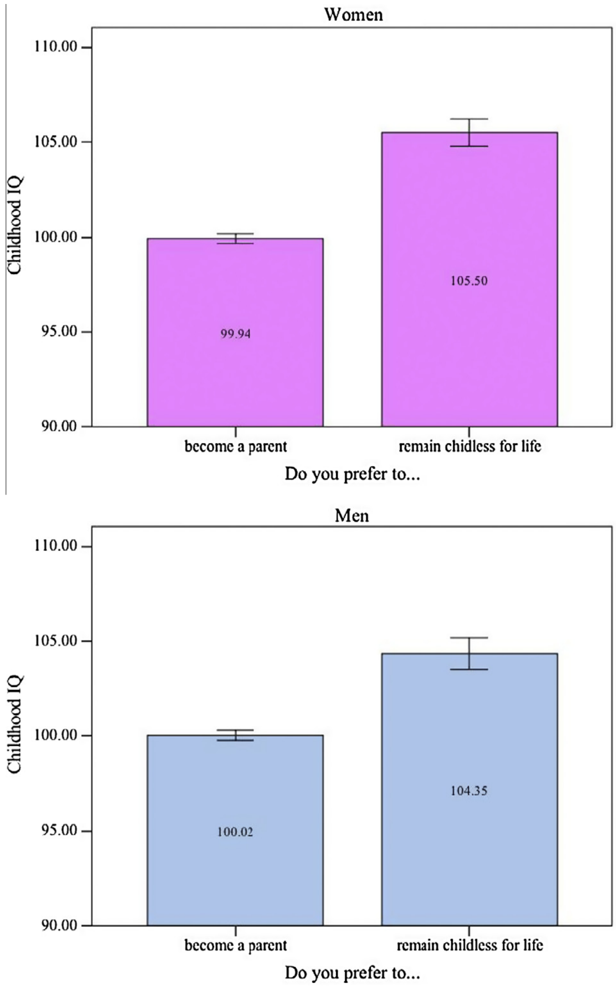

Fig. 1. Mean childhood IQ by preference for parenthood at age 23.

is only marginally significantly associated with preference for parenthood among women ($b = -.017$, $p = .057$) and not at all among men ($b = .007$, *ns*). It is interesting to note that earnings at 23 is significantly *negatively* associated with preference for parenthood among women and significantly *positively* associated with it among men. Women who earn more money at 23 are more likely to want to remain childless whereas men who earn more money at 23 are less likely to want to do so. Religiosity has a comparable effect on the preference for parenthood among both men and women.

Table 2 presents the results of the binary logistic regression analysis of the lifetime parenthood of the NCDS respondents. Column (1) shows that, consistent with the prediction of the Hypothesis, childhood general intelligence is significantly negatively associated with lifetime parenthood among women. The standardized coefficient on odds (.747) suggests that one-standard-deviation increase in childhood general intelligence decreases the odds of becoming a parent sometime in life by 25%.

In sharp contrast, and contrary to the prediction of the Hypothesis, Column (4) shows that childhood general intelligence is not at all associated with lifetime parenthood among men. The difference in childhood general intelligence between lifetime parents and nonparents is statistically significant among women (105.3 vs. 101.7, $t = 5.135$, $p < .001$), but not among men (102.2 vs. 103.0, $t = -1.210$, *ns*). Columns (2) and (5) show that these results do not change at all for either men or women when I control for education. Childhood general intelligence, net of education, is still statistically significantly negatively associated among women, but not among men.

Column (3) shows that further controlling for earnings, religiosity at 23, lifetime number of marriages, childhood social class, number of siblings, mother's education, and father's education does not much attenuate the effect of childhood general intelligence on lifetime parenthood among women. With all the controls, one-standard-deviation increase in childhood general intelligence is now associated with 21% decrease in the odds of lifetime parenthood.

A comparison of standardized effects on odds shows that the childhood general intelligence has a greater effect on lifetime parenthood than any other variables in the equation except for earnings at 23. Women who earn more at 23 are

Table 2
The effect of general intelligence on lifetime parenthood National Child Development Study (1958–2005).

	Women			Men		
	(1)	(2)	(3)	(4)	(5)	(6)
Childhood IQ	−.020***	−.019***	−.016*	.004	.004	.014
	(.004)	(.005)	(.008)	(.004)	(.005)	(.008)
	.747	*.758*	*.792*	*1.063*	*1.063*	*1.240*
Education at 23		−.071	.008		−.001	.029
		(.049)	(.080)		(.050)	(.083)
		.903	*1.012*		*.999*	*1.042*
Earnings at 23			−.176***			.126**
			(.052)			(.040)
			.739			*1.338*
Religiosity at 23			.005			.048
			(.068)			(.080)
			1.006			*1.053*
Lifetime number of marriages			−.746			−1.030
			(.859)			(1.244)
			.921			*.891*
Family of orientation						
Social class at birth			−.015			−.186
			(.100)			(.102)
			.985			*.827*
Number of siblings at 16			.028			.149**
			(.055)			(.056)
			1.052			*1.317*
Mother's education			−.005			.013
			(.072)			(.079)
			.993			*1.018*
Father's education			.029			−.031
			(.063)			(.067)
			1.048			*.951*
Intercept	3.716	3.784	3.571	.910	.964	−.283
	(.423)	(.492)	(.780)	(.372)	(.426)	(.729)
χ^2 (df = 1/2/8)	26.739***	34.356***	26.071**	1.459	1.008	25.588**
Number of cases	2654	2486	1177	2319	2159	946

Note: Main entries are unstandardized regression coefficients.
Numbers in parentheses are standard errors.
Italicized numbers are standardized effects on odds.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

significantly less likely to become parents in their lifetimes; one standard-deviation increase in earnings at 23 decreases the odds of lifetime parenthood by 26%. More importantly, contrary to the earlier findings by Retherford and Sewell (1988, 1989), Meisenberg (2010; Meisenberg and Kaul, 2010), Reeve et al. (2013), and Chen et al. (2013), education net of childhood general intelligence is not significantly associated with lifetime parenthood either for women or men.

Additional analyses show that childhood general intelligence alone entirely mediates (or explains away, as childhood general intelligence is causally prior to education) the association between education and parenthood. While education is significantly negatively associated with parenthood among women ($r = -.099$, $p < .001$) but not men ($r = -.003$, *ns*), *net only of childhood general intelligence,* partial correlation between education and parenthood is no longer statistically significant for either women ($r = -.030$, *ns*) or men ($r = -.001$, *ns*), as Columns (2) and (5) in Table 2 show. The Sobel test shows a significant statistical mediation of the association between education and parenthood by childhood general intelligence *alone* among women ($z = -1.99$, $p < .05$) but not among men ($z = 1.00$, *ns*).

Now critics might claim that it is not "fair" to compare the relative effects of childhood general intelligence and education, when the former is measured on a continuous scale and the latter is measured on a six-point ordinal scale, because, *ceteris paribus,* a continuous variable is expected to account for greater variance in a dependent variable than an ordinal variable. In NCDS, education is measured continuously only once, in Sweep 6, as the age at which the respondent left full-time continuous education. Despite the fact that the continuous measure of education is not extremely highly correlated with the ordinal measure ($r = .491$), all of my substantive conclusions largely remain the same if I use the continuous measure. Education is still significantly negatively associated with parenthood among women ($r = -.067$, $p < .001$) but not men ($r = -.027$, *ns*). Net of childhood general intelligence, education is no longer significantly associated with parenthood among women ($r = -.011$, *ns*) but it is among men ($r = -.042$, $p < .05$). The Sobel test shows a significant mediation of the association between education and parenthood by childhood general intelligence *alone* among women ($z = -2.98$, $p < .01$) but not among men ($z = 1.00$, *ns*).

6. Discussion

6.1. Discrepancy with the previous studies

My results above, which show that childhood general intelligence has a direct effect on women's lifetime childlessness even net of education and that, net of childhood general intelligence, education has no independent effect on women's parenthood, are inconsistent with some previous studies on the association between intelligence, education, and fertility. Retherford and Sewell (1988, 1989), Meisenberg (2010; Meisenberg and Kaul, 2010), Reeve et al. (2013), and Chen et al. (2013) all show either that both intelligence and education have independent effects on fertility net of each other or that education entirely mediates the effect of intelligence on fertility. How can we reconcile these discrepancies?

There are several methodological reasons. First, previous studies measure intelligence with only one or a few IQ tests, while the NCDS measures it with 11 IQ tests administered at three different ages. For example, the Wisconsin Longitudinal Study (Retherford and Sewell, 1988, 1989) measures intelligence with only one IQ test (Henmon–Nelson Test), the National Longitudinal Survey of Youth 1979 (Meisenberg, 2010; Meisenberg and Kaul, 2010; Neiss et al., 2002) uses four subtests of the Armed Forces Qualification Test (arithmetic, word knowledge, paragraph comprehension, and mathematics knowledge), and the Middle-Aged Danish Twin survey (Rodgers et al., 2008) uses five (fluency, digit-span forward, digit-span backward, digit symbol substitution, and delayed recall). While the Project TALENT data used by Reeve et al. (2013) contain scores on 11 IQ tests (the same number as in NCDS), in their factor analysis of the scores, Reeve et al. (2013, p. 360) for some reason restrict the standard deviation of the IQ metric to 10, rather than the usual 15 or 16 commonly used in intelligence research. The artificially restricted variance of the IQ measure may have contributed to their conclusion that general intelligence does not have an independent effect on fertility net of education. While the Taiwanese version of WAIS-III that Chen et al. (2013) use also has 11 subtests, their sample is extremely small ($n = 38$ women, 27 men), so it is unclear to what extent their finding that education and intelligence are independently associated with fertility net of each other is generalizable. Further research is clearly necessary to investigate the independent effects of intelligence and education on parenthood and fertility. The current study only opens, not closes, the debate.

6.2. Sample attrition

One potential problem with the NCDS data is the sample attrition rate. While the initial (Sweep 0) sample includes a *population* of babies born during one week in March 1958 in the entire Great Britain, only 54.7% of the initial respondents have participated in all seven sweeps of NCDS. (Given the nearly half-century span of NCDS, however, the retention rate may be considered very high.) While sample attrition, if systematic, often poses a threat to internal validity, it may not threaten the substantive conclusion of this paper because more intelligent individuals and parents are more likely to stay in the sample.

NCDS respondents who have participated in all seven sweeps have a significantly higher childhood general intelligence than those who have dropped out (102.1 vs. 96.4, $t = 17.932$, $p < .001$). At the same time, net of childhood general intelligence, those who are parents at 33 or 42 are significantly more likely to participate in all seven sweeps of NCDS than their nonparental counterparts (Age 33: $b = .077$, SE = .039, $p < .05$; Age 42: $b = .173$, SE = .048, $p < .001$). Net of childhood general intelligence, parental status at 23 is not significantly associated with the likelihood of participating in all seven sweeps ($b = -.018$, SE = .037, *ns*). For example, 82.7% of NCDS respondents who are parents at 42 participate in all seven sweeps, compared to 79.4% of those who are childless ($t = 3.423$, $p < .001$).

Given that the main prediction tested in the current paper is that more intelligent individuals are more likely to remain childless, the fact that more intelligent individuals and parents are simultaneously more likely to stay in the sample goes against the prediction and makes my statistical test more conservative. I therefore believe that a relatively high rate of attrition in the NCDS data does not seriously undermine the internal validity of the study.

6.3. Sex differences in the effect of intelligence on lifetime parenthood

The NCDS data provide support for the Hypothesis in my analysis of expressed preference for children early in the reproductive careers; more intelligent men and women are more likely to prefer to remain childless for life. However, in my analysis of lifetime parenthood, the NCDS data provide support for the Hypothesis only for women. More intelligent women are more likely to remain childless than less intelligent women by the end of their reproductive careers. In contrast, more intelligent men are not more likely to remain childless than less intelligent men. What accounts for the sex difference?

My finding replicates Retherford and Sewell's (1988, 1989) earlier discovery that the effect of general intelligence on completed fertility is much larger for women than for men. However, it is not clear why general intelligence does not have a negative effect on men's parenthood predicted by the Hypothesis, as it does for women. Among other things, the sex differences in the effect of intelligence on fertility imply that British couples are not very endogamous on intelligence.[3] If they were highly endogamous on intelligence and if more intelligent women are more likely to remain childless, then more

[3] I owe this insight to Lena Edlund.

intelligent men must also necessarily be more likely to remain childless. My results instead suggest that more intelligent women, who are more likely to remain childless, are *not* married to more intelligent men, and vice versa.

One possibility is that women find intelligent men attractive as mates. Miller (2000a, 2000b) has consistently argued that women preferentially select men with higher levels of intelligence to mate with. Given that mating for mammalian species is largely a female choice (Trivers, 1972), women's preference for intelligent men as mates can potentially explain why more intelligent men may be as likely to become parents as less intelligence men despite their expressed preference to remain childless at 23.

There does not appear to be much evidence for this possibility in the NCDS data, however. Net of the same control variables as above, childhood general intelligence does not significantly increase the number of times that men have been married or the probability that they have ever been married. However, more intelligent men are significantly ($p < .05$) more likely to be *currently* married at 47. At any rate, the lifetime number of marriages is controlled in Table 2, Column (6).

Another possibility is that more intelligent women must make a difficult tradeoff between career and family, and thus end up having fewer children or no children at all, whereas more intelligent men do not have to make such a choice. This can potentially explain why more intelligent women are more likely to remain childless, whereas intelligence does not affect men's parenthood.[4]

However real such tradeoffs that intelligent women face in their lives are, however, it is not likely to explain the sex differences in the effect of childhood general intelligence on parenthood that I find above. In the multiple binary logistic regression equation above, both education and earnings are controlled for. If more intelligent women are more likely to opt for careers rather than motherhood, one would expect them to have more education and higher earnings than less intelligent women, and such women with greater education and earnings should be more likely to remain childless.

The results in Table 2 show that, while earnings at 23 does significantly affect women's lifetime parenthood, education does not. Net of general intelligence and all the other control variables included in the equation, more educated women are *not* less likely to become parents by the end of their reproductive careers, although women with higher earnings are. Most importantly, the effect of childhood general intelligence on lifetime parenthood remains even after controlling for education and earnings. More intelligent women are more likely to remain childless for life even net of education and earnings.

A large number of past studies have shown that more educated women are more likely to remain childless for life (Bloom and Trussell, 1984; Jacobson and Heaton, 1991; Kiernan, 1989; Mosher and Bachrach, 1982; Poston and Kramer, 1986; see Bloom and Pebley, 1982 for review). However, *none* of these studies measure and control for the women's general intelligence. The results presented in Table 2, Column (3), suggests that education in these studies may have been confounded with intelligence, and that it may be women's general intelligence, not necessarily their education, which influences their likelihood of remaining permanently childless.

6.4. Potential macrolevel consequences

General intelligence is known to be highly heritable (Jensen, 1998, but see Taylor, 2010), and the genes that influence general intelligence are thought to be located on the X chromosomes (Lehrke, 1972, 1997; Turner, 1996a, 1996b). It means that boys inherit their general intelligence from their mothers only, while girls inherit their general intelligence from their mothers and from their fathers. So women influence the general intelligence of the future generations more than men do.[5] If more intelligent women are more likely to remain childless, as my analyses of the NCDS data above seem to suggest, then one potential consequence is that the average level of general intelligence may decline over time.

Throughout the 20th century, the average level of intelligence in most western industrial nations steadily increased, in a phenomenon initially known as the Flynn Effect (Flynn, 1984, 1987) but more recently known as the Lynn-Flynn Effect (Beaujean and Guiling, 2006; Lynn, 1982; Rushton, 1997; Voracek, 2006). Although there is no consensus on what caused the Lynn-Flynn Effect (Neisser, 1998), one likely candidate is the increasing levels of infant and childhood nutrition and health (Lynn, 1990, 1998). These factors likely more than compensated for the dysgenic fertility – where less intelligent parents are more likely to have children as documented in this paper – throughout the 20th century, and the average level of intelligence has increased in most advanced industrial nations.

Improved health and nutrition as a potential cause of the Lynn-Flynn Effect, however, would predict that the secular rise in general intelligence would halt in advanced industrial nations: The optimal level of nutrition has long passed and now obesity and diabetes have become serious problems in such societies. If improved health and nutrition are chiefly responsible for the secular increase in intelligence, and if these factors no longer contribute to the increase, then the negative effect of the dysgenic fertility should lead to a *decreasing* level of average intelligence in advanced industrial nations (Lynn and

[4] Thank Paula England and Diane J. Reyniers for independently suggesting this possibility.

[5] I owe this insight to Christopher Badcock. If mothers have greater influence on children's intelligence than fathers do, it implies that the mother–child correlation in IQ is greater than the father-child correlation. There is some suggestion that this might indeed be the case. Jester et al.'s (2009) structural equation model shows that the effect of mother's IQ on child's IQ (*beta* = .54) is slightly stronger than the effect of father's IQ (*beta* = .52). Neiss and Rowe (2000) show that the correlation between mother's education (as a proxy for IQ) and child's IQ is $r = .41$, whereas the correlation between father's education and child's IQ is $r = .36$. At Age 33, the NCDS selects a subset of respondents and administers 2–5 IQ tests (depending on age) to all of their children. I compute the correlation between the respondent's childhood IQ and the eldest child's IQ. The mother–child correlation is statistically significantly positive ($r = .190$, $p < .01$), while the father-child correlation is only marginally so ($r = .127$, $p = .088$). I thank one anonymous reviewer for pointing out this implication of the greater influence of mother's than father's intelligence on children's intelligence.

Harvey, 2008). There is in fact strong evidence that the Lynn-Flynn Effect has ended at the end of the 20th century, and the average level of intelligence has begun to decline at the beginning of the 21st century in such advanced industrial nations as Australia (Cotton et al., 2005), Denmark (Teasdale and Owen 2005), Norway (Sundet et al., 2004), and the United Kingdom (Shayer et al., 2007; Shayer and Ginsburg 2009).

Preston and Campbell (1993) employ mathematical models and simulations to show that, even when low-IQ individuals have higher fertility than high-IQ individuals, the mean IQ of the population does not continue to decline forever and instead reaches a steady-state equilibrium in many cases. This is because there is sufficient intergenerational mobility between IQ categories; children do not have exactly the same IQ as their parents. In their models, Preston and Campbell use data from Reed and Reed (1965) to estimate the association between parents' and children's intelligence. Reed and Reed's (1965) data contain children's IQ and their mother's and father's IQs. Heritability of intelligence is known to be much lower in childhood (around .4) than in adulthood (around .8) (Boomsma et al., 2008).

Even with the Reed and Reed data, with their low heritabilities, however, there is very little intergenerational mobility between IQ classes. Tables 2 and 3 in Preston and Campbell (1993, p. 1002) show that children of parents both of whom have IQs above 126 have a mean IQ of 123.5 with a variance of 13.0 (SD = 3.61). Given these data, and assuming that the distribution of their IQ is normal, the probability that children of these parents end up in the IQ categories "74 or lower," "75–84," "85–95," and "96–105" is each zero to the sixth decimal point. Even in the Reed and Reed data, which underestimate heritability of adult IQ, it is impossible for children both of whose parents have IQs above 126 to have IQs below 105. Similarly, in the Reed and Reed data, it is impossible for children both of whose parents have IQs below 74 to have IQs above 106.

Nevertheless, Preston and Campbell's results largely show that the mean IQ of the population is heavily influenced by differential fertility and moves closer to the IQ of the high-fertility group. For example, under random mating (where individuals mate randomly with respect to the IQ of their mates), when heritability is high (or, in their language, when the "leakage" between IQ categories is low) and fertility and IQ are positively associated (such that higher-IQ individuals have higher fertility than lower-IQ individuals), then, at equilibrium, 41.7% of the population will have IQs above 126, another 40.9% will have IQs between 116 and 125, and *nobody* will have IQs below 94 (Preston and Campbell, 1993, p. 1012, Table 4). Under endogamous mating (when individuals mate and reproduce only with mates in their own IQ category), if IQ and fertility are positively associated, the mean IQ of the population at equilibrium will be about 113, whereas if IQ and fertility are negatively associated, the mean IQ of the population at equilibrium will be about 95 (Preston and Campbell, 1993, p. 1014, Figure 3).

The dysgenic fertility documented in this paper, coupled with the end of the Lynn-Flynn Effect, may potentially lead to a gradual decline of the average intelligence of the population of advanced industrial nations in the 21st century.

7. Conclusion

The Savanna-IQ Interaction Hypothesis, derived from the logical conjunction of the Savanna Principle and the theory of the evolution of general intelligence, predicts that more intelligent individuals are more likely than less intelligent individuals to acquire and espouse evolutionarily novel preferences and values that our ancestors did not possess throughout evolutionary history, while general intelligence does not affect the acquisition and espousal of evolutionarily familiar preferences and values. If any single value goes against the evolutionary design of biological organisms – including humans – more than any other, it is voluntary childlessness. The Hypothesis would therefore predict that more intelligent individuals are more likely to prefer to remain childless and in fact do remain childless than less intelligent individuals.

The analyses of the National Child Development Study in the United Kingdom, which has followed all babies born in Great Britain in one week in March 1958 for more than half a century, show that more intelligent boys and girls are more likely to acquire and espouse the evolutionarily novel value of lifelong childlessness in early adulthood. However, only more intelligent women are more likely to remain childless by the end of their reproductive careers; childhood general intelligence does not appear to affect men's lifetime parenthood. Since women may have greater impact on the general intelligence of the future generations, the dysgenic fertility among women – where less intelligent women are more likely to have children than more intelligent women – may lead to the prediction, supported by recent studies, that the average level of intelligence may steadily decline throughout the 21st century.

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I thank Paula England and Diane J. Reyniers for their comments on earlier drafts. I dedicate this paper to the memory of Debra Friedman. My intellectual interest in parenthood began with my collaboration with Debra while in graduate school. Sadly, she did not live long enough to see this latest statement from her rebellious intellectual child before her life was tragically cut short.

Appendix A

Descriptive statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Desire		.272***	−.120***	−.099***	−.134***	.052***	.009	−.052***	.070***	−.059***	−.071***
(2) Parenthood	.164***		−.099***	−.099***	−.165***	−.017	−.010	−.056***	.051**	−.045*	−.046*
(3) IQ	−.090***	.025		.641***	.309***	.136***	.034	.322***	−.296***	.290***	.311***
(4) Education	−.061***	−.003	.638***		.342***	.198***	−.001	.307***	−.269***	.339***	.343***
(5) Earnings	.065***	.132***	.074***	.085***		.039*	−.006	.142***	−.186***	.130***	.141***
(6) Religiosity	.066***	−.001	.064***	.121***	.016		.003	.084***	−.040**	.068***	.066***
(7) Number of marriages	.016	−.010	.001	−.013	−.012	−.014		−.009	−.009	.004	−.018
(8) Social class	−.022	−.010	.300***	.284***	.041*	.092***	−.007		−.150***	.264***	.356***
(9) Siblings	.050**	.055**	−.274***	−.216***	−.073***	.028	−.017	−.149***		−.126***	−.116***
(10) Mother's education	−.046**	−.015	.292***	.290***	−.007	.056***	.010	.281***	−.123***		.565***
(11) Father's education	−.035*	−.012	.315***	.334***	−.001	.087***	−.004	.363***	−.126***	.566***	
Mean	.897	.832	100.018	2.148	1.842	1.129	.011	2.803	2.442	3.952	3.926
SD	.304	.374	14.591	1.434	1.717	1.156	.110	1.032	1.819	1.398	1.627
Mean	.887	.790	99.983	2.308	3.366	.798	.013	2.813	2.477	3.883	3.883
SD	.316	.408	15.386	1.416	2.311	1.068	.112	1.022	1.850	1.354	1.617

Note: Descriptive statistics for women are above the diagonal and in italics. Descriptive statistics for men are below the diagonal and in Roman.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

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