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Evidence of dysgenic fertility in China

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ABSTRACT

The relationship between fertility, intelligence, and education was examined in China using a large sample sourced from the population-representative China Family Panel Studies (CFPS) dataset. For the 1951–1970 birth cohort, the correlation between fertility and gf was −.10. The strength of recent selection against gf in China substantially increased between the 1960s and the mid-1980s. Later (between 1986 and 2000), the speed of decline in gf due to selection stabilized at about .31 points per decade with a slightly downward trend. The total loss from 1971 to 2000 due to dysgenic fertility is estimated to be .75 points. A negative relationship between educational attainment and fertility was additionally found. Both negative relations were stronger for women.

1. Introduction

In modern times, mortality rates have been reduced as a result of improvements in public health, nutrition, and the control of infectious diseases (Lynn, 2011). As a result, selection against deleterious mutations has been relaxed. Additionally, in many societies, individuals with lower levels of intelligence and education have begun to reproduce at higher rates than those with higher levels of these traits. Due to a reversal of selection for socially important traits such as intelligence, genes promoting these traits may decline. This phenomenon is termed dysgenics. Intelligence has been found to influence many outcomes both on the individual and societal levels. For example, individual differences in g are related to educational performance (Deary, Strand, Smith, & Fernandes, 2007; Poropat, 2009), occupational performance (Schmidt & Hunter, 2004), social mobility (Forrest, Hodgson, Parker, & Pearce, 2011; Krzyżanowska & Mascie-Taylor, 2013; Nettle, 2003; Sorjonen, Hemmingsson, Lundin, Falkstedt, & Melin, 2012; Waller, 1982), health (Gottfredson, 2004), and longevity (Calvin et al., 2011). National differences in measured intelligence are related to economic performance (Lynn & Vanhanen, 2002). Regarding this latter association, cross-lagged analysis and other studies suggest that the direction of causality runs largely from the former to the latter (Christainsen, 2013; Rindermann, 2008, 2012). Reconstructed differences in g scores across time also predict temporal variation in both innovation rates and the frequencies of eminent individuals (Woodley, 2012; Woodley & Figueredo, 2013).

Owing to the social importance of intelligence, the issue of population changes in this trait is important. Interest in this issue, which goes back to the 19th and early 20th century (Darwin, 1871; Galton, 1865; Morel, 1857; Pearson, 1901; Spencer, 1873) has recently increased. A recent meta-analysis by Woodley of Menie (2015) summarizing various studies (Burt, 1948; Cattell, 1937; Lentz, 1927; Loehlin, 1997; Lynn, 1999, 2004; Meisenberg, 2010; Reeve, Lyerly, & Peach, 2013; Retherford & Sewell, 1988; Sutherland & Thomson, 1926; Thomson, 1950; Vining, 1995) found that the loss of g due to dysgenic fertility during the 20th century has been about .385 points per decade in the UK and US. Selection against intelligence has also been found in economically developing countries, such as Kuwait, Sudan, and Libya (Abdel-Khalek & Lynn, 2008; Al-Shahomee, Lynn, & Abdalla, 2013; Khaleefa, 2010). Moreover, it has been found that, by the middle of the 20th century, populations in Asian, African, Latin American, and Middle Eastern countries exhibit negative relations between fertility and both social status and educational attainment (Skirbekk, 2008), traits which correlate with intelligence. Seemingly paradoxically, this trend of dysgenic fertility has occurred alongside a secular increase in measured intelligence (Flynn, 1987, 2009).

In light of these findings, Woodley and Figueredo (2013) have proposed the “co-occurrence model”. According to this, dysgenesis primarily acts on the more heritable general intelligence factor (from now on: heritable g) whereas the Flynn effect primarily represents an increase in the more environmentally conditioned specific cognitive abilities (from now on: environmental s). On this basis, dysgenesis and the Flynn effect co-occur, with environmental s gains masking the decline in heritable g at the level of phenotypic (i.e., measured) IQ scores. According to the

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model, a historical decline in g can be detected when certain indicators of latent general ability are used, such as ratio-scale measures like simple reaction times, which have been slowing in the UK and US since the 19th century (Woodley, te Nijenhuis, & Murphy, 2014) and backwards digit span, which has been decreasing in the US since the 1920s (Woodley of Menie & Fernandes, 2015), and also knowledge of hard-to-learn words, the use of which has been declining in English language texts since the 1850s (Woodley of Menie, Fernandes, Figueredo & Meisenberg, 2015). Furthermore, performance on measures of IQ that are sensitive to the Flynn effect will begin to decline as a result of a decline in heritable g when the effect of improvements in the environment stall. A decline in phenotypic IQ appears to have already begun in parts of the developed world, including Norway, Denmark, Netherlands, Finland, and France (Dutton & Lynn, 2014, 2015; Sundet, Barlaug, & Torjussen, 2004; Teasdale & Owen, 2008; Woodley of Menie & Dunkel, 2015; Woodley & Meisenberg, 2013b). Consistent with the co-occurrence model, dysgenic fertility and losses on phenotypic IQ scores are more pronounced on subtests with higher g-loadings (Peach, Lyerly, & Reeve, 2014; Woodley & Meisenberg, 2013a, 2013b; Woodley of Menie, Figueredo, Dunkel, & Madison, 2015).

To date, no research has investigated the reproductive ecology of intelligence in China, which contains one-fifth of the world's population. The present study investigates the relationship between intelligence and family size in mainland China using data from the China Family Panel Studies (CFPS) survey.

2. Method

The data come from the China Family Panel Studies (CFPS), a series of longitudinal surveys funded by the 985 Programme of Peking University and carried out by the Institute of Social Science Survey (ISSS) of Peking University. It is planned for these surveys to be carried out biennially on nationally representative samples drawn from 25 provinces in mainland China. Full details of the sampling procedures are given by Xie and Hu (2014). In 2012 the surveys used memory and number-sequence questions to test the participants' fluid intelligence (gf) level. This offered a unique opportunity to examine the relationship between gf and fertility in the population of China.

The STATA script for the analysis is available to download as part of the online supplement material.

The following variables were used in the present study:

2.1. Children

Data on the number of children were based on the participants' answers about their children. Only those children with age information were counted. Because children who died in childhood are of little interest from a reproductive viewpoint, children marked as deceased were dropped.

2.2. Sibship size

Sibship size information for adults came from the CFPS 2010 survey. For the 1951–1970 birth cohort, sibship size for 85% of the sample was available. Sibship size for children was assigned based on the parental reported number of children.

2.3. Intelligence

The cognitive tests used in 2012 were composed of two word memorization tests and a number series test, both of which measure gf. Short term memory ability, in particular, has been found to be moderately to highly correlated with gf (Aben, Stapert, & Blokland, 2012; Martínez et al., 2011; Unsworth & Engle, 2007). With the memory tests, respondents were read a randomly selected list of ten simple nouns (e.g., rice, river, and doctor) and were immediately asked to recall as many of those words as possible. The number of words that the respondents correctly recalled was recorded as their immediate word recall score. After thirty-one questions concerning subjective wellbeing, or approximately 5 min of delay, they were asked to recall the words again. The number of words recalled was recorded as their delayed word recall score. With the number series test, respondents were asked to identify the pattern of missing items in a number series and to fill in the missing numbers. This test had two stages. The difficulty level of the second stage was based on the respondents' performance in the first one. In our analysis, the W-score, which took into account both the selection of and the performance in the second stage, was used. Crystallized intelligence (gc) measures given in the 2010 survey were additionally used. These included verbal and math tests, which included problems drawn from textbooks used in primary and secondary schools. For a more detailed discussion, see Huang, Xie, and Xu (2015). The raw scores were scaled into a normally distributed and standardized score ($M = 100$, $s = 15$) for each age and gender group for samples younger than 81. Older samples were scaled together for each gender. These tests were administered to participants aged 10 and older. While almost all of the samples in this age range in the 2010 survey had verbal and math scores, the participation rate for the gf tests was lower. For the 37,003 participants, who fell in the age range considered, that took the long form of the questionnaire, answer rates were, respectively, 93%, 92%, and 48% for the immediate word recall, delayed word recall, and number series test.

The low response rate for the number series test was due to some respondents demonstrating considerable difficulty in understanding the introductory examples of the test. Those with a younger age, from higher income families and with more education were more likely to complete this test (Xu & Xie, 2015). Their fertility and sibship size was also lower than the total participants'. For the birth cohort 1951–1970, the correlation between fertility and participation in the number series test was −.13. The fertility of participants was lower by 0.13 children. To address the issue of sampling bias both due to selective participation with regards to the gf tests and due to missing data on sibship size, the sampling weight was adjusted with an inverse propensity weighting method using a logit regression model which included the square of age, mean-centred age, years of education, urban or common residence, and gender. With the weight adjustment, the fertility and sibship size of number series test takers became closer to the value of the total participants in the majority of the groups analysed. For the total sample, the difference became 0.02 children. See Supplementary Table S1 for a comparison of results with and without the weight adjustment. Sample sizes are also included in the table.

In this study, we separately analysed the relationship between each subtest indicator and fertility and sibship size. In some analysis, only the weighted average results (with the two memory tests averaged and weighted at 50% and the number series test weighted at 50%) were reported.

2.4. Education

Educational attainment and years of education were analysed. The years of education variable was transformed into a normally distributed and standardized score for each age group and gender, so as to represent the relative level of education within peer groups.

2.5. Hukou type

Hukou (household registration) refers to a socio-economic division between rural (agricultural) and urban (non-agricultural) populations in China. Data on the sample's 3-year-old, 12-year-old, and current *hukou* type were used. Note, some of the people born outside the birth planning quota are unregistered (Greenhalgh, 2003). They have no *hukou* status and were not included in the subgroup analyses.