Personality and Individual Differences 134 (2018) 107–118

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

A systematic review of the state of literature relating parental general cognitive ability and number of offspring

Charlie L. Reeve[a,*], Michael D. Heeney[a], Michael A. Woodley of Menie[b,c]

[a] Department of Psychological Science, The University of North Carolina at Charlotte, USA
[b] Department of Psychology, Technische Universität Chemnitz, Germany
[c] Center Leo Apostel at the Vrije Universiteit Brussel, Belgium

ARTICLE INFO

Keywords:
Intelligence
Cognitive ability
'g'
Reproductive success
Meta-analysis
Dysgenic trend

ABSTRACT

The purpose of this study is to conduct a systematic review of the literature on the relationship between general cognitive ability and fertility among modern humans. Our goals were to (a) evaluate the state of the extant literature, and (b) provide a quantitative summary of effect sizes to the extent possible (given the limitations of the literature). A thorough search identified 17 *unique datasets* that passed the inclusion criteria. Using a Random Effects Model to evaluate the data, the overall weighted effect was $r = -0.11$, although the data also indicated a sex effect (stronger correlations among females than males), and a race effect (stronger correlations among Black and Hispanic populations compared to Whites). Importantly, the data suggest the correlation has been increasing in strength throughout the 20th century (and early 21st). Finally, we discovered several notable limitations of the extant literature; limitations that currently prohibit a psychometric meta-analysis. We discuss these issues with emphasis on improving future primary studies to allow for more effective meta-analytic investigations.

1. Introduction

Several studies have documented an inverse relationship between cognitive ability and number of offspring in modern societies (sometimes termed "dysgenic fertility", e.g. Lynn, 1996), which has, in turn, resulted in both predictions and observations of a declining 'genotypic' IQ (e.g., Kong et al., 2017; Lynn, 1996; Lynn & Harvey, 2008). More recently, research has linked this association to secular trends suggestive of long-term phenotypic declines in general cognitive ability (*g*) (Sarraf, 2017; Woodley of Menie et al., 2017). This trend, if present at a broad scale, would negatively affect occupational, educational, and social outcomes at the individual level, and our ability to solve social problems in an increasingly complex world (Neiss, Rowe, & Rodgers, 2002; Rindermann, 2012, 2018; Rindermann, Sailer, & Thompson, 2009). For example, Woodley of Menie and colleagues (e.g., Woodley, 2012; Woodley of Menie et al., 2017) reported evidence of a strong association between a decline in *g* (as measured using convergent phenotypic indicators) and a decline in per capita macro-innovation rates (i.e. the frequency of disruptive or 'breakthrough' innovations). Woodley of Menie (2015) also reported a small meta-analysis of studies reporting empirical estimates of IQ loss due to dysgenic reproduction in U.S. and U.K. populations. After correction for method artifacts, reliability and validity, the data revealed an aggregate *g* loss of −0.38 IQ points per decade.

A decrease in our ability to innovate solutions to complex problems could have serious implications for the future of humanity. As such, the aim of this review is to enhance our understanding of the negative relationship between cognitive ability and number of offspring (NoO) by conducting a systematic review of, and a quantitative descriptive summary of the extant empirical literature. Our specific goals are to (a) provide a descriptive summary of the distribution of effect sizes found in the literature, and (b) highlight methodological concerns with the primary literature vis-a-vis potential meta-analytic studies. We begin by presenting multiple, complimentary theoretical perspectives leading to a hypothesis of a negative relationship between cognitive ability and number of offspring in modern societies. Following this, we report a quantitative summary of effect sizes found in the extant literature. Finally, we discuss the implications of our quantitative findings, and the state of the literature with respect to its ability to support potential formal meta-analyses.

1.1. General cognitive ability ('g')

"Intelligence" may be best conceptualized as a collection of closely-related constructs, structured hierarchically in a tightly-knit nomological network, with *g* reflecting the critical core of intelligence, namely

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[*] Corresponding author at: Department of Psychological Science, University of North Carolina at Charlotte, 9201 University City Boulevard, Charlotte, NC 28223-0001, USA.
E-mail address: clreeve@uncc.edu (C.L. Reeve).

https://doi.org/10.1016/j.paid.2018.05.036
Received 17 April 2018; Received in revised form 25 May 2018; Accepted 26 May 2018

the ability to learn from and reason with novel information (Jensen, 1998; Reeve & Bonaccio, 2011). Empirical research on *g* has expanded across two primary dimensions to form what is commonly referred to as the *g*-nexus (Jensen, 1998). The vertical dimension assumes a focus on the biological and neurological bases for intelligence. Examples include the study of relationships between IQ and a range of heritable traits including reaction times, evoked potentials of the cerebral cortex, and brain pH (Herrnstein & Murray, 1994; Jensen, 1998). The horizontal dimension examines relationships between *g* and a range of personal, social, educational, occupational and health outcomes. Non-exhaustive examples of the horizontal line of inquiry include studies of the relationships between *g* and myriad indicators of psychological wellbeing (Lubinski & Benbow, 2000), physical health (Gordon, 1997; Gottfredson, 2004), religiosity (Razmyar & Reeve, 2013; Reeve, 2009), job performance (Gottfredson, 1997; Meisenberg, 2010), criminality and poverty (Gordon, 1997), and of most relevance to the current study, reproductive behavior (Reeve, Lyerly, & Peach, 2013; Lynn, 1999; Lynn & Harvey, 2008; Meisenberg, 2010; Peach, Lyerly, & Reeve, 2014; Retherford & Sewell, 1989).

1.2. Selection favoring lower g

According to evolutionary theory, *g* originally evolved as an adaptation to confer a survival advantage via the enhanced ability to adapt and survive in evolutionarily novel situations (Chiappe & MacDonald, 2005; Gordon, 1997; Jensen, 1998; Kanazawa, 2004). The advent and rise of civilization and technology lead to a modern environment which is radically different to our ancestral environment, particularly with respect to the degree of “evolutionary novelty” we encounter. As such, the behavioral advantage conferred to an individual by higher *g* is almost ubiquitous in modern society (where most of that environment is “evolutionarily novel”). However, there is one domain of modern life in which higher *g* may no longer confer the “Darwinian Advantage” it did in the ancestral environment; namely, human reproduction (i.e., increased probability of passing genes to the next generation).

Throughout human history, any form of industrialization initiates a shift away from a hunter-gather and agrarian lifestyles (common to our ancestors) where larger families were an asset for kin-group productivity and survival. As human culture and technology began to fundamentally change our daily environment into a largely “evolutionarily novel” one (Kanazawa, 2010), the traditional Darwinian advantage for larger numbers of offspring began to erode. For example, medicine began to reduce the infant mortality rate (thus, one did not need to have large numbers of offspring to ensure survival of at least a few), and large numbers of offspring were more likely to be an economic liability rather than a resource, for most people. Ergo, the ability to discern the personal advantage of limited reproduction (though clearly not a *genetic* reproductive advantage), and the ability to control one's reproduction independent of copulation, became a catalyst for reduced reproduction at the individual level. In other words, sexual reproduction became an “evolutionarily novel” proposition. Such theorems were coined the “Internal Relaxation/Reversal of Darwinian Selection” (IRDS) by Nyborg (2012), and are widely cited as the underlying drivers of the negative *g*-NoO relationships observed in a large and growing body of empirical literature (Lynn & Van Court, 2004; Herrnstein & Murray, 1994; Lynn & Harvey, 2008; Nyborg, 2012; Woodley & Figueredo, 2013).

Another theoretical perspective that makes similar predictions is *Population cycle theory* (Woodley of Menie et al., 2017). It proposes, that for most of human history, colder climates promote inter-group conflict because it makes vital resources scarcer (e.g., food, proper shelter, fertile ground). Such conditions should place a fitness premium on *g* because those who are better able to solve novel problems or learn critical skills faster will be better able to survive and prosper in difficult environments. Higher *g* also leads to more innovations that can give a population an edge in inter-group conflict. Conversely, warmer climates are proposed to reduce this ecological stress on populations (relatively speaking), and thus the fitness value of *g* would be much lower (i.e., variance in *g* would have less impact on selection). Thusly, historically, we should see evidence of increasing *g* over time in populations living in colder climates, and a weaker increase in populations historically isolated in warmer climates (see also Lynn, 1991, and Rushton, 1995, for similar arguments). The prediction that evolutionary novelty increases with colder climates, and that both novelty and the increased selection pressures of cold climates influence reproductive trends has been corroborated (Kanazawa, 2008).

Similar to the previous theories, population cycle theory also suggests that greater ecological and social stability stemming from increased global temperature, coupled with advances in technology, over the last 200 years have significantly changed the pattern of selection on *g* by artificially raising the odds favoring reproduction of those with lower *g*, relative to those with higher *g*, who, as was mentioned previously, can use innovations such as contraception to attenuate their fertility. Under such conditions, one would expect to see those with lower *g* exhibiting higher fitness. To empirically test the population cycle theory, Woodley of Menie et al. (2017) tracked the utilization frequencies of the four high-difficulty words from WORDSUM across 400 years of Google Ngram viewer data. The utilization frequencies of these words served as a proxy vocabulary IQ test (which is highly *g*-loaded; Kan, Wicherts, Dolan, & van der Maas, 2013). First, their analyses showed that the utilization frequencies of the common factor among these words increases between 1500 and 1850, and declines precipitously thereafter. Second, and importantly, they were able to empirically predict this cycle using variations in (a) both the mean and variance in global temperature, and (b) strength of intergroup competition pressures.

Finally, it is critical to point out why our theories focus on *g* as the putative variable, rather than other non-*g* skills and abilities. First and foremost, the negative correlation between IQ and fertility has been shown to be a Jensen Effect. A Jensen Effect refers to the empirical finding that effect sizes (e.g., heritability coefficients, predictive validity coefficients, mean differences in average phenotypic intelligence, etc.) typically correlate significantly with the subtests' *g*-loadings – meaning that *g* can be said to moderate the association. Said differently, the Jensen effect refers to the finding that measures with higher *g*-saturation are better than lower *g*-saturated measures at differentiating between individuals and groups in outcomes that are influenced by IQ. A number of studies have found large and significant Jensen effects for the Black–White mean test score difference (e.g., te Nijenhuis & van den Hoek, 2016), inbreeding depression scores, evoked potentials, brain pH, reaction times, test heritabilities (Jensen, 1998; van Bloois, Geutjes, te Nijenhuis, & de Pater, 2009), and sex differences (Nyborg, 2005) among others. Jensen effects have also been found to explain variability on non-biological variables such as differences in retest effects (e.g., Reeve & Lam, 2007) and race differences in work criteria (Reeve & Bonaccio, 2009).

While the negative association between scores on cognitive tests and NoO has acquired increasing empirical support and scientific publicity, there remains some skepticism as to whether these effects are truly due to differences in *g*, partly because specific estimates of the fertility gradient appear to vary somewhat depending on the specific ability measure used. However, it has been shown that the magnitude of the fertility gradient is positively moderated by the *g*-loading of cognitive ability measures (making it a *Jensen Effect*). For example, Peach, Lyerly, and Reeve (2014) used the Project Talent database to conduct a correlated vectors analysis by correlating the vector of *g*-loadings of the ability subtests with the vector of computed fertility gradients (i.e., the correlations between each subtest and the number of biological children). The strength of the Jensen effect was $r = 0.89$ among the full sample. These findings indicate that the fertility gradient is strongly proportional to the *g*-loading of the test, thus confirming the hypothesis that *g* is the primary factor on which selection operates. More recently,