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The social and scientific temporal correlates of genotypic intelligence and the Flynn effect

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ABSTRACT

In this study the pattern of temporal variation in innovation rates is examined in the context of Western IQ measures in which historical genotypic gains and losses along with the Flynn effect are considered. It is found that two alternative genotypic IQ estimates based on an increase in IQ from 1455 to 1850 followed by a decrease from 1850 to the present, best fitted the historical growth and decline of innovation rates ($r=$ .876 and .866, $N=56$ decades). These genotypic IQ estimates were found to be the strongest predictors of innovation rates in regression in which a common factor of GDP (PPP) per capita and Flynn effect gains along with a common factor of illiteracy and homicide rates were also included ($\beta=.706$ and .787, $N=51$ decades). The strongest temporal correlate of the Flynn effect was GDP (PPP) per capita ($r=.930$, $N=51$ decades). A common factor of these was used as the dependent variable in regression, in which the common factor of illiteracy/homicide rates was the strongest predictor ($\beta=-1.251$ and -1.389, $N=51$ decades). The genotypic IQ estimates were significant negative predictors of the Flynn effect ($\beta=-.894$ and $-.978$, $N=51$ decades). These relationships were robust to path analysis. This finding indicates that the Flynn effect, whilst associated with developmental indicators and wealth, only minimally influences innovation rates, which appear instead to be most strongly promoted or inhibited by changes in genotypic intelligence.

1. Introduction

Many individuals have attempted to predict the future, some in a non-scientific manner (e.g. via religion) and some in a scientific manner. Those who identify with the scientific tradition today use the label of futurology to describe their efforts and employ a variety of techniques in "divining" future social and scientific trends. There is no clear consensus amongst futurologists as to what the future will be like, with some predicting social and scientific stagnation and possibly also decline (e.g. Cowen, 2011; Horgan, 1997; Huebner, 2005a), and others predicting massively accelerated growth in science, technology and knowledge. Those in the latter camp have coined a word to describe this hypothetical future in which accelerating returns from technological progress fundamentally alters both human society and nature — *singularity* (after the exponential function). Singularity is to be achieved through the development of technologies such as human-like artificial intelligence (AI) and biological immortality which will (ideally) recursively enhance and empower human capabilities (Drexler, 1992; Kurzweil, 2004; Vinge, 1993).

Here it will be demonstrated that essential to any attempt at understanding and predicting changes in innovation is knowledge of the ways in which intelligence has changed over the course of the centuries, and indeed might continue to change in the future. This is especially important as a number of researchers have identified significant associations between scientific and technological achievement and IQ both at the individual differences (e.g. Lubinski, Benbow, Webb & Bleske-Rechek, 2006) and country-level scales (e.g. Gelade, 2008; Rindermann, Sailer, & Thompson, 2009; Rindermann & Thompson, 2011).

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In this paper, after a review of the dysgenesis and Flynn effect literatures, historical trends in a number of key indicators including genotypic intelligence, the Flynn effect, and GDP (PPP) per capita amongst others will be analyzed in an effort to identify the key predictors of trends in science and technology. In the context of this the two main models of the future of science and technology (i.e. stagnation/decline and accelerating returns) will be assessed in terms of plausibility.

1.1. Has IQ changed over time?

1.1.1. Dysgenesis

Dysgenesis describes the tendency for a heritable and socially valued trait (such as intelligence) to decline over time within a population as a result of differential fertility disfavouring the trait. Galton (1869) was one of the first to discuss the phenomenon and also to use the term, although he lacked a sufficiently sophisticated method of intelligence measurement to effectively quantify it.

Early in the 20th century, negative correlations were observed between intelligence and fertility, which were taken to indicate a dysgenic fertility trend (e.g. Cattell, 1936; Lentz, 1927; Maller, 1933; Sutherland, 1929). Early predictions of the rate of dysgenesis were as high as between 1 and 1.5 IQ points per decade (Cattell, 1937, 1936). However, the longitudinal study of Maxwell (1954) conducted between 1932 and 1947, which employed the Scottish Survey, found the opposite — namely that IQ had *increased* by around 2.3 points in 15 years. Cattell (1951) also reported a 1.2 point increase in mean IQ amongst English 10-year old samples tested in 1936 and also in 1950.

A variety of theories were proposed to account for these contradictory findings, namely, that intelligence was increasing despite the fact that less intelligent individuals were having more children. Some of these theories foreshadowed modern explanations for the Flynn effect by stressing environmental factors such as education and improved communications (Tuddenham, 1948). One theory emphasized the supposed eugenic fertility enhancing properties of democracy (Osborn, 1940).

Studies conducted on cohorts reproducing during the 'baby boom' years (late 40s and 50s) typically found *positive* correlations between IQ and completed fertility (see van Court & Bean, 1985 for an overview). This led to speculation that eugenic fertility for intelligence was rather the norm than the exception (Falek, 1971; Osborn & Bajema, 1972). Subsequent research cast doubt on the relevance of these studies owing to the limited range of locations from which the samples were sourced, and also the narrow range of birth cohorts considered (e.g. Cattell, 1974; Jensen, 1969; Vining, 1982). Vining (1982) argued that the correlation between IQ and fertility should be either neutral or positive during periods of rising fertility, but negative during periods of declining fertility — which characterize the years on either side of the 'baby boom'. In their study of the relationship between intelligence and both completed and partially completed fertility, van Court and Bean (1985) reported that the relationships were predominantly negative in cohorts born between the years 1912 and 1982. They argue that reports of apparent eugenic fertility might have been restricted to specific cohorts living in specific regions.

A variety of studies have presented estimates of genotypic IQ declines for a variety of populations. Here genotypic IQ is defined as the intelligence that people exhibit if they have access to optimal environments. This is distinct from phenotypic IQ, which is observed and measured IQ resulting from the influence of both genetic and environmental factors (Lynn, 1996). Vining (1982) was the first to have attempted an estimation of the rate of genotypic IQ decline due to dysgenesis with reference to a large national probability cohort of US women aged between 24 and 34 years in 1978. He identified significant negative correlations between fertility and IQ ranging from −.104 to −.221 across categories of sex, age and race, with an estimated genotypic IQ decline of one point a generation. In a 10-year follow-up study using the same cohort, Vining (1995) re-examined the relationship between IQ and fertility, now that fertility was complete, finding evidence for a genotypic IQ decline of .5 points per generation.

Retherford and Sewell (1988) examined the association between fertility and IQ amongst a sample of 9000 Wisconsin high-school graduates (graduated 1957). They found a selection differential that would have reduced the phenotypic IQ by .81 points per generation under the assumption of equal IQs for parents and children. With an estimate of .4 for the additive heritability of IQ, they calculated a more modest genotypic decline of approximately .33 points.

The study of Ree and Earles (1991), which employed the NLSY suggests that once the differential fertility of immigrant groups is taken into consideration, the phenotypic IQ loss amongst the American population may be greater than .8 of a point per generation. Similarly, in summarizing various studies, Herrnstein & Murray (1994) suggest that "it would be nearly impossible to make the total [phenotypic IQ decline] come out to less than one point per generation. It might be twice that." (p. 364).

Loehlin (1997) found a negative relationship between the fertility of American women aged 35–44 in 1992 and their educational level. By assigning IQ scores to each of six educational levels, Loehlin estimated a dysgenesis rate of .8 points in one generation.

Significant contributions to the study of dysgenesis have been made by Lynn, 1996 (see also: 2011) whose book *Dysgenics: Genetic deterioration in modern populations* provided the first estimates of the magnitude of dysgenesis in Britain over a 90 year period, putting the phenotypic loss at .069 points per year (about 1.7 points a generation assuming a generational length of 25 years). In the same study, Lynn estimated that the genotypic IQ loss was 1.64 points per generation between 1920 and 1940, which reduced to .66 points between 1950 and the present. Subsequent work by Lynn has investigated dysgenesis in other populations. For example Lynn (1999) found evidence for dysgenic fertility amongst those surveyed in the 1994 National Opinion Research Center survey, which encompassed a representative sample of American adults, in the form of negative correlations between the intelligence of adults aged 40+ and the number of children and siblings. Lynn estimates the rate of dysgenesis amongst this cohort at .48 points per generation. In a more recent study, Lynn and van Court (2004) estimated that amongst the most recent US cohort for which fertility can be considered complete (i.e. those born in the years 1940–1949), IQ has declined by .9 points per generation.