Intelligence 43 (2014) 27–34

Contents lists available at ScienceDirect

Intelligence

Controlling for increased guessing enhances the independence of the Flynn effect from *g*: The return of the Brand effect

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ARTICLE INFO

Article history:
Received 26 June 2013
Received in revised form 4 November 2013
Accepted 16 December 2013
Available online 22 January 2014

Keywords:
Brand effect
Flynn effect
g loadings
Jensen effect

ABSTRACT

The cause of the Flynn effect is one of the biggest puzzles in intelligence research. In this study we test the hypothesis that the effect may be even more independent from *g* than previously thought. This is due to the fact that secular gains in IQ result from at least two sources. First, an authentic Flynn effect that results from environmental improvements and should therefore be strongly negatively related to the *g* loading (and therefore the heritability) of IQ subtests. Second, a "Brand effect", which results from an increase in the number of correct answers simply via enhanced guessing. As harder items should encourage more guessing, secular gains in IQ stemming from this Brand effect should be positively associated with subtest *g* loadings. Analysis of Estonian National Intelligence Test data collected between 1933 and 2006, which includes data on guessing, *g* loadings and secular IQ gains, corroborates this hypothesis. The correlation between gains via the Brand effect and *g* loadings is .95, as predicted. There is a modest negative association between raw secular gain magnitude and subtest *g* loadings (−.18) that increases to −.47 when these are controlled for the Brand effect. Applying five psychometric meta-analytic corrections to this estimate raises it to −.82 indicating that the authentic Flynn effect is substantially more independent from *g* than previously thought.

1. Introduction

Much controversy surrounds the finding of a three point per decade secular gain in measured IQ (Flynn, 1984, 1987, 2009, 2012), usually referred to as the Flynn effect (Herrnstein & Murray, 1994). A variety of factors have been proposed as causative of this effect. These include nutrition (Flynn, 1987), education (Husén & Tuijnman, 1991), improvements in hygiene (Eppig, Fincher, & Thornhill, 2010), decreases in environmental neurotoxin levels (Nevin, 2000), increased familiarity with or sensitivity to the solution rules of tests (Armstrong & Woodley, 2014) and the presence of cultural amplifiers, which via positive feedback lead to large gains in IQ on the basis that smarter populations also demand greater cognitive stimulation (Dickens & Flynn, 2001). Heterosis or hybrid vigor has also been proposed as both a minor and a major causative factor in secular gains (Jensen, 1998a; Mingroni, 2004, 2007). Another theory is that the gains result from changing test-taking habits — specifically the tendency towards the use of rapid guessing on timed multiple-choice-type answer formats under circumstances where easily learned strategies can be used to reduce the numbers of wrong answers, thus increasing the odds of selecting correct answers by chance alone (Brand, 1987a,b, 1990, 1996; Brand, Freshwater, & Dockrell, 1987). Jensen (1998a) argued that the rapidity of the gains rules out a non-environmental origin except possibly in the US during the opening decades of the 20th century, where increased admixture with European immigrants might have resulted in small gains due to heterosis.

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http://dx.doi.org/10.1016/j.intell.2013.12.004

1.1. Gains in g?

One of the biggest controversies surrounding the potential causes of the gains concerns the idea that they may be in some way associated with a change in the level of *g* or the general factor of intelligence within populations. Some have argued that this must be the case as the effect seems to be associated with real-world improvements such as increasing precociousness in games like chess, bridge and go (Howard, 2001) and increasing brain size (Lynn, 1989). Much progress has been made towards better understanding the causes of the gains via the use of the method of correlated vectors, or the correlation between the *g* loading of a subtest and the size of the gains associated with that subtest. A strong positive vector correlation between secular gains and subtest *g* loading would indicate that the gains are a Jensen effect i.e. that their relation with intelligence is positively mediated by *g*. An anti-Jensen effect means that there is a strong negative correlation between the *g* vector and the *d* vector and strongly suggests that the effect is independent of *g*, and that the effect instead occurs on subtest-specific sources of variance. Different studies have produced different results from applying this method to the pattern of secular gains. These results range from the finding that with respect to literacy in Estonia the gains are a perfect anti-Jensen effect (−1; Must, Must, & Raudik, 2003a), to the finding that they are a strong Jensen effect on Fluid intelligence measures in Spain (.78; Colom, Juan-Espinosa, & García, 2001). The preponderance of studies do however indicate that the pattern of gains are either negatively or non-correlated with subtest *g* loadings. This was demonstrated recently in a psychometric meta-analysis of over 17,000 individuals and 12 studies, which revealed that the 'true' vector correlation between the pattern of secular gains and subtest *g* loadings is −.38 (te Nijenhuis & van der Flier, 2013). This indicates that the gains are definitely not a Jensen effect and are substantially but perhaps not completely independent of *g*. The meta-analysis also shows that the differences in outcomes between various studies can be perfectly explained by just five statistical artifacts, such as sampling error and reliability. When the theoretically expected effect is +1 or −1 the method of correlated vectors can most likely be applied to test batteries with as few as four subtests. However, when the theoretically expected effect is in the vicinity of 0 the method appears to become very sensitive to the effect of outliers and most likely requires at least seven subtests for a reliable outcome. This could explain the extreme outlier that is the study by Colom et al. (2001), as it was based on just five subtests.

The issue of whether or not the pattern of secular gains is a Jensen effect is important in terms of inferring causation. Wholly genetically-influenced variables, such as subtest heritabilities (Rushton & Jensen, 2010), inbreeding depression (Jensen, 1998a; Rushton, 1999) and hybrid vigor or heterosis (Nagoshi & Johnson, 1986) are associated with strong Jensen effects in all cases, whereas purely environmental effects, such as IQ gains via retesting (te Nijenhuis, van Vianen, & van der Flier, 2007) and gains due to adoption (Jensen, 1998b) are strong anti-Jensen effects. So, there is a cluster of genetic effects yielding a correlation of +1 with *g* loadings and a cluster of cultural–environmental effects yielding a correlation of −1 with *g* loadings. On this basis, certain causal theories of the Flynn effect can be ruled out, such as the idea that it results primarily from the effects of heterosis (Mingroni, 2004, 2007).

As was mentioned previously, on the basis of the results of meta-analysis, the pattern of secular gains is clearly not a Jensen effect. However it is not enough of an anti-Jensen effect to completely rule out potential genetic causes also. Rushton (1999) for example found a clear negative vector correlation between five secular gains and subtest *g* loadings. He also found that four out of the five sets of secular gains included in his analysis exhibited both strong loadings on an environmental factor in a factor analysis and small positive loadings on a genetic factor. te Nijenhuis and van der Flier (2013) argue that there may be a quite modest role for heterosis in secular gains. A quite modest role could be interpreted as 5 to 10% of the overall gains. There are several problems with this hypothesis however, chief amongst which is the fact that inbreeding was never that prevalent in the West historically (Flynn, 2009). Furthermore recent research reveals that levels of *g* have been declining in the West, as indicated by a psychometric meta-analysis of the secular slowing of simple reaction time means between the 19th and 21st centuries (Silverman, 2010; Woodley, te Nijenhuis, & Murphy, 2013). The average decline in *g* across cohorts may be equivalent to around −1.16 points per decade, or −13.35 points between 1889 and 2004. The most likely cause of this is the presence of dysgenic fertility in many Western cohorts between the end of the 19th century and the present day (Woodley et al., 2013). It must be noted that the finding has not been received uncritically (Dodonova & Dodonova, 2013; Flynn, 2013; Nettelbeck, 2014; Silverman, 2013). Despite this, granting our premise, the magnitude of dysgenic fertility is strongly positively mediated by the *g* saturation of subtests, hence is an undisputed Jensen effect (Reeve, Lyerly, & Peach, 2013; Woodley & Meisenberg, 2013). Therefore as *g* cannot be simultaneously rising and falling (Woodley, 2011) an alternative explanation must be sought for both the lack of a perfect anti-Jensen effect on the pattern of secular gains, and the presence of cross-loadings in Rushton (1999).

Finally, a position maintained by some researchers (i.e. Jensen, 1998a) is that for secular gains to be meaningful they must involve gains in *g*, as it is asserted that this is the sole source of criterion validity in IQ tests. The idea therefore is that a 'hollow' secular gain is a meaningless one. This model is increasingly at odds with the data indicating that completely 'hollow' test-score variance is able to predict real-world performance, albeit within narrow parameters (Coyle & Pillow, 2008), and also that the presence of large numbers of individuals capable of cognitively specializing can lead to group-level increases in aggregate efficiency or a sort that might have driven the massive growth in wealth throughout the 20th century (the historical trend in wealth growth strongly parallels the growth in secular gains; Woodley, 2012). A wholly 'hollow' gain in ability strengthens theoretical models requiring that for massive secular gains to have had an impact on the real world, they need to be completely independent of *g* (Flynn, 2009; Woodley, 2012).

1.2. Higher scores due to guessing: the Brand effect

One possibility concerns an older causal theory of secular IQ gains which was proposed by Brand (1996), and is based