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COMMENTS OFF ON RISING TIDES AND LEAKY BOATS – QUITE AN OLD PHENOMENON

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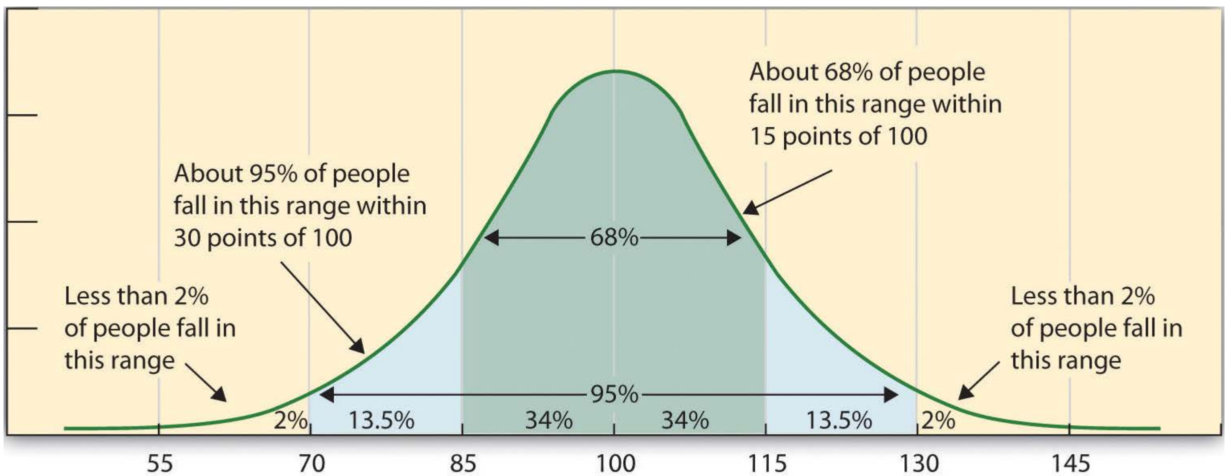

by Dr. Raegan Murphy

Increasing intelligence?

When investigating intelligence test score data (commonly referred to as IQ scores) since the 1900s we see that these scores have increased over time. This temporal secular upward trend has been greeted with some amount of positive enthusiasm. The concurrent up- and downward movement of intelligence markers have left us wondering what is going on in intelligence test score data and by implication, our brains. Intelligence markers refer to test scores on IQ tests, for example – which have been going up over time – but it can also refer to genetic information which code for intelligence and include detrimental and beneficial alleles. Traditionally, Flynn effects (the increase in test score data over time first documented by Runquist in 1936 [Lynn, 2011; 2013] but re-discovered by Richard Lynn and James Flynn in the latter half of the 20th century) have accounted for the increase of IQ test score data over the past 100 years. The Flynn effect is now established fact with a very large literature attesting to the effect around the globe (Trahan, Stuebing, Fletcher, & Hiscock, 2014). We have known of this upward trend since the 1930s. We also know that different items from the standard fare of intelligence test components have varying degrees of *g*-loading. *g* loadings reflect the amount of variance explained by each sub-component in terms of overall *g*; in essence, *g*-loadings represent correlations with global *g* which is the summary component of all underlying IQ test scores. A low *g*-loaded item on an IQ test, for instance, means that the item does not 'tap into' the higher order level of global intelligence. In a way, one can say that low *g*-loaded items do not reflect intelligence as is commonly understood by psychologists. These items, though, often test narrow abilities which are often useful in everyday life. *g* is variant across time and population and as such it is a measure of an item's loading within the specific context of measurement. Gains in measured IQ scores correlate negatively with the *g*-loadings (te Nijenhuis, 2013).

Not on g

Flynn effects are not on *g* (te Nijenhuis, & van der Flier, 2013) as research has consistently shown that changes in Flynn effects are robustly and negatively associated with changes in *g*-loadings (Woodley & Madison, 2013). We know that psychometric *g* genetically co-varies with scholastic achievement (Luo, Thompson, & Detterman, 2003) the latter often being used as a proxy for intelligence test score data in the absence of IQ scores (a method used mainly post World War II). Environmental explanations account for the Flynn effect and there is unanimity in the literature attesting to the global temporal improvements in education (Baker, Eslingerc, Benavides, Peters, Dieckmann & Leon, 2015; te Nijenhuis & van der Flier, 2013).

'Genetic g'

Researchers are in the process of untangling the genetic and non-genetic variance components of these items acknowledging that practice and familiarisation does enhance some component of test score data and reflects a retesting artefact. However, the gains made in IQ test scores are in effect 'hollow' because most of the gains are made on low *g*-loaded items – which, as described above, consist of items on an IQ test which do not 'tap into' global intelligence but reflect narrow abilities which often show improvement over time when practised (te Nijenhuis, 2013; te Nijenhuis & van der Flier, 2007). This gain component is not heritable and is not amenable to genetic selection effects. IQ test scores have improved over time but these improvements are basically due to environmental 'practice' effects.

Understanding genetic contributions to intelligence is an area being investigated and is still at an early stage. At the moment it is accepted that there are no known 'intelligence' genes (Rindermann, 2015) but genome wide association studies are making enormous headway in this area (Piffer, 2015) and we know that intelligence is highly heritable and polygenic (Davies et al, 2011). Single nucleotide polymorphisms are increasingly revealing associations with intelligence test score data with some alleles being associated with higher intelligence and some with lower intelligence ('beneficial' and 'detrimental'). Effects of different genes are additive as the greater the number within any one individual the greater the likelihood of higher intelligence (Loo et al, 2012). A number of studies have concluded that a significant proportion of individual differences in human intelligence is due to genetic variation, with a number of genes making small contributions to the overall additive genetic influence on intelligence. More specifically, studies investigating high IQ samples have evidenced impressive explained variance for genes on measured IQ with lower amounts of explained environmental variance contributing to high IQ (Haworth et al, 2009).

The Anti-Flynn and Jensen effects

What is interesting is that certain geographical regions are now witnessing an anti-Flynn effect (that is, decreasing IQ score trends over time) which means that our environments are no longer as conducive to higher performance in intelligence tests. The anti-Flynn effect we now see happening in some developed countries is a matter related mostly to environmental impingements (such as poorer educational environments both at home and at school). These IQ losses are found mostly on non-*g* based items (narrow ability items) (Dutton & Lynn, 2013) although some researchers are of the opinion that the anti-Flynn effect shows a modest Jensen effect (Woodley & Meisenberg, 2013b). The Jensen effect is seen when subtests' *g*-loadings correlate positively with the magnitude of the gains of these subtests. A positive vector correlation is thus a Jensen effect and these effects are highly biological in origin and exist for non-human primates as well (Woodley, Fernandes & Hopkins, 2015). Subtests with higher *g*-loadings are associated with larger dysgenic fertility gradients; that is, the accumulation/perpetuation of disadvantageous genes and traits (Woodley, & Meisenberg, 2013a). Most of the subtests' score increases over time are not Jensen effects and the fact that anti-Flynn effect shows modest Jensen effects points us in the direction of genetic components of *g*. Jensen effects include, among others, inbreeding depression, evoked potentials, brain pH, subtest heritabilties, reaction time, fluctuating asymmetry and dysgenic fertility differentials. Regarding inbreeding depression, there is a negative correlation between national IQ scores and consanguinity (Woodley, 2009). Of note is that eugenic/dysgenic trends in IQ seem to predict the per capita rate of major innovations over the past 500 years while the Flynn effect appears to be related to per-capita GDP growth (Woodley & Meisenberg, 2013a). This is interesting because part movers of GDP today represent ever-increasing numbers of narrow ability niche areas of innovation. For instance today, science moves forward due to more localised findings rather than fewer large impact findings. This is partly due to the fact that many scientific findings have already occurred. Future advances rely increasingly upon smaller scale findings from teams of researchers rather than from a few grand findings made by individuals. Increases in genetic *g* from around 1455–1850 occur alongside increased rates of innovation and show a marked decrease over the next 150 years concurrent with decreased genetic *g* (Woodley, 2012). Narrow abilities load less on genetic *g* and are thus more amenable to Flynn effects. We also know that *g* has been subjected to stronger selection pressures in comparison to narrower, more domain-specific abilities (Fernandes, Woodley & te Nijenhuis, 2014). Dysgenic trends in intelligence test scores have taken place concurrently and we know that verbal ability and the number of children produced over the 1890-1970 period in the USA is negatively correlated. Moreover, the correlation is higher for females than for males in later 20th century cohorts with increased dysgenics being associated with declining fertility especially among the higher IQ female population and after the 1930s (more educated females tend to have fewer children) (Meisenberg, 2010; Meisenberg & Woodley, 2014).

Dysgenesis syndrome

The downward genetic component of intelligence trend has been discussed as far back as the 1850s and is today referred to as the dysgenesis syndrome (Woodley & Figueredo, 2013) due to the number of convergent indicators suggesting a decreasing trend for lowered intelligence. High *g*-loaded items are the most amenable to dysgenic trends but dysgenic fertility is only one mechanism partly explaining the resultant decrease in the genetic component of intelligence test score data. Another contender is deleterious mutation load (Woodley, 2015) which is a by-product of selecting for traits hitherto not normally selected for in our ancestral past. Dysgenic fertility suggests that individuals with low *g* have displayed reproductive advantages since the industrial revolution, in comparison to those with high *g*. This is mainly due to increased health care for all individuals in society. Many poorer individuals were less likely to have had access to health care in the past. How do we know that genetic *g* has changed and how do we know the direction of this change? We know the correlations between various chronometric measures of *g*, like simple reaction time, and *g*-loaded items on intelligence tests. We also know that simple reaction times have been steadily decreasing over the past 100 years (Woodley, te Nijenhuis & Murphy, 2013; Woodley, te Nijenhuis & Murphy, 2014) – probably longer, but we have no robust data prior to the 1880s. Simple reaction time measures are robust measures of genetic *g*, are highly heritable and load very strongly on *g*. Simple reaction time has significantly decreased over time and hence we can say that genetic *g* ‘scores’ have decreased. This co-occurs with the upward trend in non-genetic *g* ‘scores’. The reason why this finding is important is because there is likely to be fewer high IQ individuals in future. With fewer gifted people in the world, fewer patents will be filed and thus fewer ‘giant leaps’ will be made in the area of science and technology.

Cattell’s paradox or the co-occurrence model

This co-occurrence model (already written about as early as 1937 by Cattell and known then as Cattell’s paradox) is best explained with the rising-tides-leaky-boats analogy (Loehlin, 1997). Flynn effects result in the boats rising whilst the decrease in genetic *g* causes the boats to lower as a result of leakage. So, whilst the performance of narrow abilities across a wider range of individuals is improving, the quality of genetic *g* is deteriorating. Many studies show that both Flynn and anti-Flynn effects occur on specific subtest components in tandem which is the co-occurrence model. This has been explained by reference to the hybrid effects which suggests that small dysgenic losses in IQ might have diminished cultural-environmental quality in such a way that amplifies the losses further (Woodley & Meisenberg, 2013a). One of the consequences of the dysgenic syndrome is the decreased number of gifted individuals which is reflected in the per-capita decline of eminent individuals (Murray, 2003) and as Meisenberg (2010) states: ‘The proportion of highly gifted people with an IQ higher than 130 will decline by 11.5% in one generation and by 37.7% in one century’ (p.228). Further evidence supportive of the co-occurrence model (and by implication the dysgenic trend in intelligence) is the historical changes in the utilization frequencies of words from the highly *g*-loaded WORDSUM test (Woodley, Fernandes, Figueredo & Meisenberg, 2015). As expected, opposing trends are evidenced on high and low *g*-loaded words with the former trending downwards and the latter upwards (and hence reflective of the Flynn effect). Also, there is evidence to suggest that sensory discrimination, specifically colour acuity (but also sound and weight discrimination) has decreased over the past century (Woodley & Fernandes, submitted). Sensory discrimination and *g* are highly correlated and colour acuity shows a Jensen effect. Lastly, digit span forwards (which is less *g*-loaded because it requires only repetition) has shown a Flynn effect over the last 90 years but digit span backwards (which is more *g*-loaded because it requires more than mere repetition) has shown a concurrent decrease over the same period (Woodley & Fernandes, 2015). There are a number of issues which do muddy the waters somewhat. *g* loadings change over time and may be sample dependent (Beaujean & Sheng, 2014). Hence gains and losses are not necessarily associated with factorial invariance and changes cannot be attributed to changes in the latent constructs. In other words, global intelligence accounted for more IQ test scores gains in the past than is the case today. It also seems that the manifold strength of *g* declines over time. But this may be partly explained by the increasing use of narrow abilities (a consequence of living in the modern day). It may well be that the *g* factor influenced performance over a broader array of abilities in the past than is the case today.

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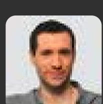

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