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THE "JENSEN EFFECT" AND G VECTOR ANALYSIS

Book Review of Jensen on Intelligence-g-Factor

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Abstract

Jensen's method of correlated vectors is the jewel in the crown of his 30-year research on the nature of Spearman's g. Significant correlations between g-factor loadings and other variables, "Jensen Effects," are discussed here in relation to Black/White differences.

Keywords

behavior genetics, cognitive modelling, evoked potentials, evolutionary psychology, factor analysis, g factor, heritability, individual differences, intelligence, IQ, neurometrics, psychometrics, psychophyiology, skills, Spearman, statistics 1. Sir Francis Galton's (1822-1911) book "Hereditary Genius" (1869) predated by exactly one century the famous 1969 Harvard Educational Review article that led "Jensenism" to be defined as "the theory that an individual's IQ is largely due to heredity, including racial heritage" (Random House; Webster's Unabridged). Jensen's (1969) review of the evidence that IQ is heritable and that genetic factors are involved in the Black-White IQ gap had enormous impact. Nonetheless, Jensen's main scientific goal has been to understand the nature of intelligence rather than race differences as such.

2. The jewel in the crown of Jensen's legacy is his development of the method of correlated vectors. A "vector" of scores is a set that possesses both direction and quantity. Jensen has applied the method of correlated vectors (fully explicated in Appendix B of Jensen 1998) to many collections of variables and shown that the vector of a test's g loadings is the best predictor not just of that test's correlation with scholastic and work-place performance, but with brain size, brain pH, brain glucose metabolic rate, average evoked potential, reaction time, and other physiological factors, hence establishing the biological (as opposed to the mere statistical) reality of g.

3. Consider the correlation between IQ and brain size. Numerous modern studies confirm that the correlation between IQ and head circumference measured by tape is about 0.20 and that between IQ and brain volume measured by Magnetic Resonance Imaging is about 0.40 (Jensen 1998, Chapter 6). Using the method of correlated vectors shows the correlation with g to be between 0.60 and 0.70! Jensen's method has distilled the essence of intelligence

4. In a recent special issue of the journal INTELLIGENCE honoring Jensen's accomplishments, I proposed that when a significant correlation occurs between the two vectors, the result be called a Jensen Effect (for that X variable), because otherwise there is no name for it, only a long explanation of how the effect was achieved (Rushton, 1998). The Jensen Effect can be seen whenever there is a significant correlation between the vector of the sub-tests' g loadings and the vector of the same sub-tests' loadings on variable X (where X is some other, usually nonpsychometric, variable).

5. Jensen Effects are not omnipresent and their absence can be as informative as their presence. An important case of the absence of the Jensen Effect is that of the secular increase in test scores. Simply stated, the "Flynn Effect" is not a "Jensen Effect." Principal components analyses show that whereas the IQ gains over time on the WISC-R and WISC-III do cluster (suggesting they are a reliable phenomenon), these are independent of g factor loadings, the cluster of Black-White differences, and of inbreeding depression scores (Rushton, 1999). These results provide convergent and discriminant validity for the "Jensen Effect" and disconfirm Flynn's hypothesis that the "massive IQ gains over time" found in several countries prove that the Black-White differences in IQ are environmental in origin.

6. The g Factor, Jensen's monumental tome on the reality of g, actually has little to do with race, as such. The first five chapters deal with the intellectual history of the discovery of g and various models of how to conceptualize intelligence. Other chapters deal with the biological correlates of g (excluding race), its heritability, and its practical predictive power. The fact that psychometric g has many physical correlates proves that it is not just a statistical reality. Among biological variables, g loads on heritability coefficients determined from twin studies and inbreeding depression scores calculated in children born from cousin-marriages. G is related not only to brain size measured by Magnetic Resonance Imaging (MRI), but also to brain evoked potentials, and intracellular brain pH levels. G is a product of human evolution and is also found in non-human animals.

7. Despite the fact that The g Factor is not primarily about race, Jensen's discussion of g and race will strike many as being its central theme. All the issues Jensen dared to voice in 1969 are still with us today. Indeed, much of the opposition to IQ testing and heritability research would probably disappear if it were not for the stubborn and unwelcome fact that, despite extensive programs of intervention, the mean Black-White difference in g does not diminish. Chapter 11 of The g Factor fully documents that, on average, the American Black population scores below the White population by about 1.2 standard deviations (equivalent to 18 IQ points).

8. The book describes how the difference between Blacks and Whites in average IQ scores has scarcely changed over the past 80 years. It can be observed as early as three years of age. Controlling for overall socioeconomic level only reduces the mean difference by 4 IQ points. Culture-fair tests tend to give Blacks slightly lower scores, on the average, than more conventional tests, as do non-verbal tests compared with verbal tests, and abstract reasoning tests compared with tests of acquired knowledge. On average, Blacks also score 1 standard deviation below Whites in academic achievement throughout the period from grades 1 through 12 (and also considerably below all other disadvantaged minorities tested: Puerto Rican, Mexican-American, and American Indian).

9. The g Factor does not draw back from its most controversial conclusions -- that the average difference in IQ between Blacks and Whites has a substantial hereditary component, and that this difference has important societal consequences. Jensen Effects encompass Spearman's (1927) specific hypothesis about the heritability of the Black-White IQ gap. The "Spearman-Jensen hypothesis" (as Travis Osborne, 1980, dubbed it), that Black-White IQ differences are greatest on the g-factor, is tested by first extracting the g factor from a variety of cognitive tests (a vector of scores), and then relating these scores to the mean Black-White differences on those same tests (a second vector of scores). Early tests of this hypothesis were summarized in BEHAVIORAL AND BRAIN SCIENCES and responded to with open peer commentary (Jensen, 1985, 1987).

10. Jensen's book reviews the results of numerous subsequent investigations of the Spearman-Jensen hypothesis using a wide variety of psychometric tests administered to large representative samples of Whites and Blacks. Chapter 11 describes the results from 17 independent data sets on a total of nearly 45,000 Blacks and 245,000 Whites derived from 171 psychometric tests. G loadings consistently predict the magnitude of the Black-White difference (r = +.63). The rank correlation between the g loadings and the Black-White differences is +.71 (p <.05).

11. These g related population differences are not due to factors such as the reliability of the test, social class differences, or tautologies based on some inevitability of factor analysis. Indeed, it is not even universally true that all groups that differ, on average, in their overall score on a test battery will conform to the Spearman-Jensen hypothesis. In South Africa, although the nearly 1 standard deviation difference between Whites and East Indians showed no correlation between g loadings and standardized mean differences, the 2 standard deviation difference between Whites and Blacks showed a correlation of +.62.

12. The Spearman-Jensen hypothesis applies even to the g factor extracted from performance on elementary cognitive tasks. In some of these studies, 9-to-12-year-olds are asked to decide which of several lights is illuminated and move their hand to press a button that turns that light off. All children can perform the tasks in less than one second, but children with higher IQ scores perform faster than do those with lower scores, and White children, on average, perform faster than Black children. The correlations between the g loadings of these types of reaction time tasks and the Black-White differences range from +.70 to +.81.

13. When Jensen examined East Asian-White comparisons using these same reaction time measures the direction of the correlation was opposite to that in the Black-White studies. On average, East Asians scored higher in g than do Whites. No one so far seems to have looked at East Asian-White differences on conventional psychometric tests as a function of their g-loadings. From the study just mentioned, however, Jensen's prediction is clear: A Jensen Effect should be found indicating an East Asian advantage.

14. Chapter 12 presents Jensen's technical arguments for why he believes that Black/White differences are about 50 percent heritable. He emphasizes the fact that it is precisely those components of intelligence tests that are most heritable and that most relate to brain size which most profoundly differentiate Blacks from Whites. Direct evidence comes from transracial adoption studies carried out on Korean and Vietnamese children adopted into White American and White Belgian homes. Though many had been hospitalized for malnutrition, prior to adoption, they went on to develop IQs ten or more points higher than their adoptive national norms. By contrast, Black and Mixed-Race (Black-White) children adopted into White middle-class families typically perform at a lower level than similarly adopted White children. In the well known Minnesota Transracial Adoption Study, by age 17, adopted children with two White biological parents had an average IQ of 106, adopted children with one Black and one White biological parent averaged an IQ of 99, and adopted children with two Black biological parents had an average IQ of 89.

15. The g Factor (Chapter 6) reviews the literature that found that the brain-size/IQ relation was most clearly shown using Magnetic Resonance Imaging (r = .44 across eight separate studies). Chapter 12 cites my own review of the literature (Rushton & Ankney, 1996) that documents the three-way Asian/White/Black gradient in brain size established by aggregating data from studies using four kinds of measurements: (a) wet brain weight at autopsy; (b) volume of empty skulls using filler; (c) volume estimated from external head sizes; and (d) volume estimated from external head measurements and corrected for body size. East Asians and their descendants average about 17 cm3 (1 in3) larger brain volumes than do Europeans and their descendants, whose brains average about 80 cm3 (5 in3) larger than do those of Africans and their descendants. Jensen calculated an "ecological" correlation (widely used in epidemiological studies) of +0.99 between median IQ and mean cranial capacity across the three populations of "Mongoloids," "Caucasoids," and "Negroids."

16. The g Factor is a gold mine of information, a sourcebook for researchers, and a volume that critics as much as supporters have an obligation to read.

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