



Raven's test performance of sub-Saharan Africans: Average performance, psychometric properties, and the Flynn Effect

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ABSTRACT

This paper presents a systematic review of published data on the performance of sub-Saharan Africans on Raven's Progressive Matrices. The specific goals were to estimate the average level of performance, to study the Flynn Effect in African samples, and to examine the psychometric meaning of Raven's test scores as measures of general intelligence. Convergent validity of the Raven's tests is found to be relatively poor, although reliability and predictive validity are comparable to western samples. Factor analyses indicate that the Raven's tests are relatively weak indicators of general intelligence among Africans, and often measure additional factors, besides general intelligence. The degree to which Raven's scores of Africans reflect levels of general intelligence is unknown. Average IQ of Africans is approximately 80 when compared to US norms. Raven's scores among African adults have shown secular increases over the years. It is concluded that the Flynn Effect has yet to take hold in sub-Saharan Africa.

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1. Introduction

In 2007, Nobel laureate James Watson sparked controversy by expressing his gloom about the future of Africa in the light of the finding that sub-Saharan Africans have lower average IQ test scores than the peoples in the other parts of the world (The Sunday Times, October, 14, 2007). Although some scientists responded that his statements were “unsupported by science” (Federation of American Scientists, press release, October, 18, 2007), others responded more positively (Malloy, 2008; Rushton & Jensen, 2008). Notably, Lynn and Vanhanen (2002, 2006) collated the results of more than 50 published studies in which western IQ tests were administered to Africans. They concluded that the average IQ of the populations of sub-Saharan Africa in terms of UK norms lies below 70 (Lynn, 2006; Rushton & Jensen, 2005). Malloy (2008) also reviewed the literature on this issue and arrived at a similar conclusion. According to Rushton and Jensen (2009), this low average IQ suggests that African adults have the cognitive ability of an average 11-year-old white teenager. This assertion strikes us as unlikely and so the work by Lynn and Vanhanen and others raises the following questions: (1) Is their estimate of the average IQ of sub-Saharan Africans accurate? (2) How should we interpret IQ test performance of Africans? (3) Is IQ test performance of Africans a cause for concern about the prospects of sub-Saharan Africa? The aim of the present paper is to address these questions by presenting a balanced and critical evaluation of the present body of results of IQ testing in sub-Saharan Africa.

To estimate average IQ in countries all over the world, Lynn (and Vanhanen)¹ drew mainly on published data from Raven's Coloured Progressive Matrices (CPM; J. C. Raven, 1956) and the Standard Progressive Matrices (SPM; J. C. Raven, 1960). The Raven's tests are generally considered to be good non-verbal indicators of general intelligence or *g* (Carroll, 1993; Jensen, 1998), at least in western samples, and have often been administered in sub-Saharan Africa. For instance, Fahrmeier (1975) collected CPM data of schooled and unschooled Nigerian children. Lynn (and Vanhanen) compared their CPM scores to British norms² and calculated an average IQ of about 69 (Lynn, 2006; Lynn & Vanhanen, 2002). In another study conducted in Nigeria, Wober (1969) administered the SPM twice to a group of male factory workers. Lynn (and Vanhanen) compared their pretest scores to British norms, and concluded that their average IQ was below 65.

¹ Whenever we refer to “Lynn (and Vanhanen)” in this paper, we refer to Lynn and Vanhanen (2002, 2006) and to Lynn (2006), because the literature reviews in these three books overlap strongly. We refer to specific books whenever necessary.

² The estimation of IQ is described as follows: “Around 1973, data for the Coloured Progressive Matrices for a sample of 375 6–13 year-olds were collected by Fahrmeier (1975). In relation to the 1979 British standardization of the Standard Progressive Matrices, the mean IQ is 70. Because of the 6-year interval between the two data collections, this needs to be reduced to 69” (Lynn & Vanhanen, 2002, p. 215). Lynn (and Vanhanen) probably used a table provided on page 60 of the SPM manual (J. C. Raven et al., 1996) to convert raw CPM scores to raw SPM scores, to compare these CPM scores to British SPM norms of 1979. Note that their downward correction for outdated norms is an error because the norms are more recent than the test scores in Fahrmeier's sample. Hence, according to the appropriate use of this correction (i.e., 2 IQ points per decade), the IQ should have been raised by one point, not lowered by one.

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On the basis of these convenience samples, Lynn and Vanhanen (2002) claimed that the average IQ in Nigeria is below 70.

Lynn (and Vanhanen)'s work on IQ of Africans is often taken at face value (e.g., Herrnstein & Murray, 1994; Sarich & Miele, 2004; Skuy et al., 2002; Te Nijenhuis, De Jong, Evers, & van der Flier, 2004), even by their critics (e.g., MacEachern, 2006). The estimates of the average IQ of Africans are accorded a central role in the discussion on Black–White differences in IQ by Rushton and Jensen (2005, 2008, 2009), and these estimates feature in several evolutionary theories of intelligence (Kanazawa, 2004; Lynn, 2006; Rushton, 2000). Moreover, Lynn and Vanhanen's (2002, 2006) estimates of “national IQ” (i.e., an estimate of the average IQ of nations' inhabitants) have been used in at least twenty-five scientific studies (e.g., Barber, 2005; Dickerson, 2006; Gelade, 2008a,b; Jones & Schneider, 2006; Kanazawa, 2006, 2008; Ram, 2007; Rindermann, 2007, 2008a,b; Templer, 2008; Templer & Arikawa, 2006). Nevertheless, the work by Lynn (and Vanhanen) has also drawn criticism (Barnett & Williams, 2004; Ervik, 2003; Hunt & Carlson, 2007; Hunt & Sternberg, 2006). One point of critique is that Lynn and Vanhanen's estimate of average IQ among Africans is primarily based on convenience samples, and not on samples representative of the relevant populations (Barnett & Williams, 2004; Hunt & Sternberg, 2006). For example, the samples of Fahrmeier ($N=375$) and Wober ($N=86$) were neither intended, nor can be considered, to be representative of the entire population of Nigeria, a country of over 130 million inhabitants.

Lynn (and Vanhanen) did not take into account a sizeable portion of the relevant literature on IQ testing in sub-Saharan Africa. For instance, they did not consider other potentially relevant studies with the Raven's tests in Nigeria that indicated that average IQ in this country is considerably higher than 70 (Maqsood, 1980a,b; Okunrotifa, 1976). Perhaps the most important drawback of Lynn (and Vanhanen)'s reviews of the literature is that they are *unsystematic*. For example, nowhere in their reviews do they provide details concerning their literature search strategy, nor did they explicate the inclusion and exclusion criteria that they employed in selecting studies. It is well known that unsystematic literature reviews may lead to biased results (Cooper, 1998). The first aim of our review is to estimate the current level of average IQ of Africans on the basis of the Raven's tests by systematic literature review.

Because mean IQ levels in many western populations have shown marked increases over the course of the twentieth century (Flynn, 2006; Neisser, 1998), the interpretation of average IQ test scores of populations must be put into historical context. The scores on the Raven's tests have shown strong increases, a.k.a. Flynn Effects, in the developed world (Brouwers, van de Vijver, & van Hemert, 2009). Although there is some indication of a similar secular trend in IQs on the CPM in Kenya in recent years (Daley, Whaley, Sigman, Espinosa, & Neumann, 2003), little is known about the Flynn Effect in sub-Saharan Africa. The second aim of our review is therefore to determine whether there has been a Flynn Effect on the Raven's tests in sub-Saharan Africa. We note that the environmental variables that have been advanced as causes of the Flynn Effect in developed nations, such as improvements in nutrition and health (e.g., Lynn, 1990), and increases in educational opportunity and attainment (Ceci, 1991) are open to improvement in sub-Saharan Africa.

IQs do *not* necessarily equal a particular level of general intelligence or g (Bartholomew, 2004), as it is necessary to consider the issue of validity in interpreting an observed score as an indication of the position on a latent variable such as g . Several authors have questioned whether IQs of Africans are valid and comparable to scores in western samples in terms of general intelligence (Barnett & Williams, 2004; Ervik, 2003; Hunt & Carlson, 2007; Hunt & Sternberg, 2006). Some (e.g., Berry, 1974) reject the very possibility of obtaining a valid measure of g in sub-Saharan Africa with western IQ tests, while others (e.g., Herrnstein & Murray, 1994; Lynn, 2006; Rushton & Jensen, 2005) consider this relatively unproblematic. This issue is

related to our third question: what is the psychometric meaning of Africans' scores on the Raven's tests, and to what degree can we interpret these scores in terms of the cognitive abilities that these tests purport to measure? To this end, we consider studies that address the validity and reliability of these tests. We also consider the psychometric issue of measurement invariance (Mellenbergh, 1989; Millsap & Everson, 1993), which is crucial (e.g., Byrne et al., 2009) to the comparability of test scores across cultural groups in terms of latent variables, such as general intelligence.

Our paper is organized as follows. In Section 2, we present the results of a systematic review of the literature on the average performance of Africans on the basis of the Raven's tests. In Section 3, we consider whether there has been a Flynn Effect among Africans on these tests. Note that in Sections 2 and 3, we describe the mean performance and trends in the IQ metric. We do this to ensure consistency with the literature, but our use of the IQ metric should not be taken to imply that we consider scores on the Raven's tests of Africans valid indicators of general intelligence. In Section 4, we collate the results of studies that have addressed the validity the Raven's tests as measures of general intelligence or g in African samples. In this section, we view g in terms of Jensen's (1998) factor analytic definition (cf. Bartholomew, 2004), which is closely related to other views on intelligence (Carroll, 1993; McGrew, 2005). We do this because this definition is amendable to psychometric modeling, but we recognize that the interpretation of g remains open to debate (Bartholomew, Deary, & Lawn, 2009; van der Maas et al., 2006). Hence, Section 4 is not concerned with the nature of g itself, but rather provides an empirical test of the prediction from the g theory (Jensen, 1980, 1998) that Raven's tests are valid indicators of g among Africans (Lynn, 2006; Lynn & Vanhanen, 2006; Rushton & Jensen, 2005; Rushton & Jensen, 2009; Rushton & Skuy, 2000).

2. Is average IQ of Africans really below 70?

In a previous study (Wicherts, Dolan, & van der Maas, 2010), we considered the IQ test performance of Africans on several western IQ tests and found that their average IQ is appreciably higher than Lynn (and Vanhanen)'s estimates suggest.³ In the current study, we attempted to locate all the published data of Africans on the Raven's tests. We explicitly discuss the criteria we used for inclusion and exclusion of particular studies. Our specific aims are to estimate the average IQ of African samples on the SPM and CPM. In Section 3, we determine whether a Flynn Effect is present in African populations. Our literature review also provided us with the opportunity to consider the psychometric properties of the Raven's tests in African samples, which we address in Section 4. Note that our review of the literature and our estimates of average IQ are concerned with the overall Black population of sub-Saharan Africa. This necessarily represents a crude generalization that can not do justice to the wide cultural, social, and economic variation in sub-Saharan Africa. We conduct more fine grained analyses whenever possible.

2.1. Method

2.1.1. Selection bias

It is well known that convenience samples may produce biased results. In estimating average scores of the population of (countries in) sub-Saharan Africa, Lynn (and Vanhanen) used published studies, which included small convenience samples (e.g., Fahrmeier, 1975; Wober, 1966) and large representative samples (e.g., Costenbader &

³ At a time when the current manuscript was ready for submission, reviewers of our other paper in *Intelligence* demanded that we include in that paper some data on the mean performance of Africans on the Raven's from the current review. We view both studies as replications of the same issue and report the main results in the current paper.

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