Personality and Individual Differences 48 (2010) 91–96

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

Review

Why national IQs do not support evolutionary theories of intelligence

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ARTICLE INFO

Article history:
Received 16 February 2009
Received in revised form 19 May 2009
Accepted 26 May 2009
Available online 24 June 2009

Keywords:
Evolutionary psychology
Flynn Effect
Race differences

ABSTRACT

Kanazawa (2008), Templer (2008), and Templer and Arikawa (2006) claimed to have found empirical support for evolutionary theories of race differences in intelligence by correlating estimates of national IQ with indicators of reproductive strategies, temperature, and geographic distance from Africa. In this paper we criticize these studies on methodological, climatic, and historical grounds. We show that these studies assume that the Flynn Effect is either nonexistent or invariant with respect to different regions of the world, that there have been no migrations and climatic changes over the course of evolution, and that there have been no trends over the last century in indicators of reproductive strategies (e.g., declines in fertility and infant mortality). In addition, we show that national IQs are strongly confounded with the current developmental status of countries. National IQs correlate with all the variables that have been suggested to have caused the Flynn Effect in the developed world.

1. Introduction

Kanazawa (2008), Templer (2008) and Templer and Arikawa (2006) set out to substantiate three theories of the evolution of intelligence relating to race differences in intelligence. The first theory (Lynn, 1991, 2006) states that higher general intelligence evolved to meet the challenge of surviving in colder and more demanding climates, than that of the environment of evolutionary adaptedness (EEA; i.e., Sub-Saharan Africa in the late Pleistocene). The second theory (Kanazawa, 2004) states that general intelligence evolved in response to new environmental challenges, i.e., challenges not previously encountered in the EEA (see also Borsboom & Dolan, 2006; Girotto & Tentori, 2008). The third theory is Rushton's (2000) differential K theory, which states that the three major human races (i.e., Whites, Blacks, and Asians) differ in levels of intelligence because of different evolved reproductive strategies. According to this theory, Blacks (or peoples who descended from Africans) are relatively more *r*-selected and less intelligent than Whites (or peoples who descended from Europeans). Whites are relatively more *K*-selected than Blacks, but less *K*-selected (and so intelligent) than (East-) Asians (or peoples who descended from East-Asians). *K* and *r*-selection strategies are thought of as the extremes of a continuum on which the races differ. The reproductive strategies are reflected by differences in brain size and intelligence (positively related to *K* strategies), and by indicators such as fertility rate, infant mortality rate, prevalence of sexually transmitted diseases (associated with *r* strategies, negatively correlated with intelligence). All three theories predict that peoples, that settled farther away from the EEA, evolved higher levels of intelligence. For instance, Sub-Saharan Africans, near the EEA, are predicted to be relatively *r*-selected, and to have lower general intelligence than peoples in Europe, Asia, and the Americas.

To test these theories, Kanazawa (2008), Templer (2008), and Templer and Arikawa (2006) computed ecological correlations between various variables at the national level and national IQs (Lynn & Vanhanen, 2002, 2006). National IQs are estimates of the mean IQ of nations' inhabitants in terms of UK norms. In the three studies, national IQs were correlated with indicators of temperature (Kanazawa, 2008; Templer & Arikawa, 2006), distance from Africa (Kanazawa, 2008), and several indicators related to the reproductive strategies of countries' inhabitants (Templer, 2008). According to Kanazawa (2008), his results "strongly support" (p. 107) his own (Kanazawa, 2004) and Lynn's (1991, 2006) evolutionary hypotheses. Templer (2008) claimed to have found support for Rushton's (2000) theory, while Templer and Arikawa (2006) concluded that their findings were "congruent with" Lynn's (1991, 2006) theory.

The aim of the current paper is to document several problems associated with correlational studies that use contemporary national IQs to test evolutionary theories of intelligence. The issues include stability of climate over the last 60,000 years; distances between points on the earth and migration of people over the course of (pre)history; and stability of population IQ levels over the course of history. In the second part of our paper we discuss the many confounds of national IQs that render empirical tests of evolutionary theories based on national IQs hard to interpret. Note that our criticisms concern the evidential force of data on national IQs with respect to evolutionary theories of intelligence, rather than the truth of these evolutionary theories per se. Also, we are not concerned here with definitional problems associated with the

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doi:10.1016/j.paid.2009.05.028

constructs of intelligence or the categorization of human genetic diversity into distinct races; for the sake of argument, we assume here that nations may differ in terms of racially dominant groups, and that (national) IQs reflect general intelligence or *g*, while recognizing that these assumptions may be problematic.

2. Temporal constancy over the course of evolution?

The evolutionary theories of Lynn, Rushton, and Kanazawa are based on the "Out of Africa" hypothesis which holds that the ancestry of all humans can be traced to a relatively small group of ancestors that lived in Eastern Africa around 60,000 years ago (Stringer & McKie, 1996). Research suggests that *Homo Sapiens* had populated most of the geographical locations in the world by about 10,000 years ago. The exact figures, and the Out of Africa hypothesis itself, remain subjects of debate (e.g., Lewin & Foley, 2004). However, this is immaterial to the points we wish to make, which include the point that the evolutionary hypotheses concern events that took place between 60,000 and 10,000 years ago, while the data, which serve to test the hypotheses, were gathered in the twentieth century.

3. Climate change

Kanazawa (2008) and Templer and Arikawa (2006) purport to substantiate theories that concern a period of around 60,000 years, but the temperature data that they used pertain to the twentieth century. Contemporary temperature data cannot be generalized to the late Pleistocene, when humans moved out of Africa. For example, temperatures during the last glacial period were much lower than present temperatures, especially in the higher latitudes of Eurasia and Northern America. That is not to say that glacial periods only affected these parts of the world. For instance, most parts of Africa suffered drought during the ice ages (Lewin & Foley, 2004). During the last glacial maximum around 18,000 years ago, flora and fauna was severely affected throughout the world (Ray & Adams, 2001). Regional temperature differences between the 20th century and the last glacial maximum depend partly on latitude, rendering the temperature data used by Kanazawa and Templer & Arikawa questionable given their stated purpose of testing evolutionary theories.

4. Changes in reproductive strategies

According to Rushton's (2000) theory, East-Asians, Europeans, and Africans differ on average with respect to several indicators of reproductive strategies. Templer (2008) correlated national IQ with contemporary data on birth rate, infant mortality rate, and the prevalence of HIV/AIDS. Templer, having found that these (negative) indicators of Rushton's *K* factor correlated more highly with national IQs than did Gross Domestic Product, claimed that this supported Rushton's theory. The problem with this study is that the data are based on one single recent time point, which cannot be assumed to be representative for the evolutionary epoch of interest. For instance, fertility rate and infant mortality rate, which are essential indicators of Rushton's reproductive strategies, display clear trends over the course of history in developed nations. In much of the twentieth century, fertility and infant mortality rates have been much higher in China than in European countries. This is inconsistent with Rushton's assertion that East-Asians are more *K*-prone than Europeans. For example, in 1955, the fertility rates in China and Singapore were much higher than those in Europe. The correlation between national IQ and fertility rate may be −.83 in 2005, but it was −.66 in 1955 (employing *N*-weighting based on population size, the correlation equals −.35). It remains to be seen what results older data would produce. Likewise, infant mortality rate in 1960 in China was 15% (details available from the first author), which was much higher than the rate in Europe at that time, and higher than the current rate in most Sub-Saharan African countries. A rigorous test of Rushton's theory should take into account such temporal changes.

5. Migration and geographic distance

Kanazawa (2008) was concerned with the relation between levels of general intelligence, as they were distributed geographically thousands of years ago, and the degree of "evolutionary novelty" of the relevant geographic locations. Lacking data regarding evolutionary novelty, Kanazawa proposed, as a measure of evolutionary novelty, the geographic distance to the EEA, i.e., a large region of sub-Saharan Africa. The idea is that the greater the distance from the EEA, the more evolutionarily novel the corresponding environment. There are several problems with this operationalization.

First, Kanazawa operationalized geographic distance using Pythagoras' first theorem ($a^2 + b^2 = c^2$). However, Pythagoras' theorem applies to Euclidian space, not to the surface of a sphere. Second, even if these calculations were accurate, distances as traveled on foot do not in general correspond to distances "as the crow flies" (Kanazawa 2008, p. 102). According to most theories, ancestors of the indigenous people in Australia (i.e., the Aborigines) moved out of Africa on foot. They probably crossed the Red Sea from Africa to present day Saudi Arabia, went on to India, and then through Indonesia to Australia. Thus the distance covered on foot must have been much larger than the distances computed by Kanazawa. This suggests that the real distances covered by humans to reach a given location, i.e., data of central interest to Kanazawa, are likely to differ appreciably from the distances as the crow flies. One can avoid this problem by using maps that exist of the probable routes that humans followed in their exodus from Africa, and estimating the distances between the cradle of humankind and various other locations accordingly (Relethford, 2004).

Third, it is not obvious that locations farther removed from the African Savannah are geographically and ecologically more dissimilar than locations closer to the African Savannah. For instance, the rainforests of central Africa or the mountain ranges of Morocco are relatively close to the Savannah, but arguably are more dissimilar to it than the great plains of North America or the steppes of Mongolia. In addition, some parts of the world were quite similar to the African savannas during the relevant period of evolution (e.g., Ray & Adams, 2001). Clearly, there is no strict correspondence between evolutionary novelty and geographic distance. This leaves the use of distances in need of theoretical justification. It is also noteworthy that given the time span of evolutionary theories, it is hardly useful to speak of environmental effects as if these were fixed at a certain geographical location.

People migrate, and have done so extensively in the time since the evolutionarily period relevant to the evolutionary theories by Kanazawa and others. A simple, yet imperfect, solution to this problem is to use data solely from countries that have predominantly indigenous inhabitants (Templer, 2008; Templer & Arikawa, 2006). However, Kanazawa used national IQs of all countries in Lynn and Vanhanen's survey, including Australia and the United States. This casts further doubt on the relevance of Kanazawa's data vis-à-vis the evolutionary theories that he set out to test. Given persistent migration, it is likely that many of the people, whose test scores Lynn and Vanhanen used to calculate national IQs, are genetically unrelated to the original inhabitants of their respective countries. In at least 50 of the 192 countries in Kanazawa's (2008) study, the indigenous people represent the ethnic minority.

6. The temporal stability of IQ-scores

Clearly, to be relevant to the current evolutionary hypotheses, contemporary data on national IQs should be relevant to populations that lived thousands of years ago. Can we assume current estimates of the mean IQ of inhabitants of, say, present day Netherlands, to be a reasonable estimate of the mean IQ in the corresponding location 15,000 years ago? We judge this assumption to be too adventurous to serve as a basis for a scientific claim, especially in view of the fact that the mean IQ of Dutch citizens, as computed in 1982 is not even a reasonable estimate of the mean Dutch IQ in 1952 (Flynn, 1987). The reason for this lies in the secular IQ gains known as the Flynn Effect (Flynn, 2007), which in the Netherlands is estimated to be in the order of 3 IQ-points per decade over the last 60 years. Knowing that national IQs can fluctuate by more than a standard deviation over 50 years, we may question the relevance of contemporary national IQs to peoples that lived thousands of years ago.

Thus, an implicit assumption in the work by Kanazawa, Templer, and Templer & Arikawa is that the Flynn Effect either does not exist or has been more or less invariant in magnitude across the globe during the twentieth century. The evidence against the assumption regarding the temporal stability of IQ-scores is as overwhelming as the evidence for the Flynn Effect (Flynn, 2007). Moreover, the claim that the size of the Flynn Effect is invariant over geographical regions and over time seems to be implausible given the strong indication that the Flynn Effect has come to a halt in developed nations (Flynn, 2007), yet is still ongoing in developing nations (Daley, Whaley, Sigman, Espinosa, & Neumann, 2003; Wicherts, 2007). Note that Lynn and Vanhanen's (2002, 2006) correction for the Flynn Effect assumes that this effect is invariant over all countries for which they estimated national IQ.

7. The many confounds of national IQ

It remains to be seen whether differences between nations in average IQ are attributable to evolutionary factors. To illustrate this point, we correlated Lynn and Vanhanen's (2006) estimates of national IQ with several environmental variables that have been suggested to contribute to the Flynn Effect. Our goal is to show that national IQs are strongly confounded with the developmental status of countries, and hence cannot be interpreted solely in evolutionary terms. We also include estimates of temperatures during the last ice age and an improved measure of geographic distance from Africa.

8. Method

To enable a comparison to the literature, we employed Lynn and Vanhanen's estimates of national IQ in countries that have mostly indigenous inhabitants (in line with Templer & Arikawa). We excluded Equatorial Guinea, because the IQ data that were used by Lynn and Vanhanen (2006) were erroneously based on a sample of mentally retarded children from Spain. We also excluded Taiwan because of missing data. The use of improved estimates for average IQs for sub-Saharan African countries (Wicherts, Dolan, & van der Maas, in press) lowers most of the correlations, but does not affect our main conclusion.

The developmental data were drawn from websites of the United Nations (UN), and World Health Organization (WHO). We averaged the variables over periods of several years, but stress that the exact choice of the period had little effect on the results. Details on the variables are available from the first author.

Nutrition. Lynn (1990) proposed improved nutrition as a cause of the Flynn Effect. We used averages over the years 1985–2000 of the following three nutritional variables: averages per capita of calories per day, proteins in kg per day, and fat in kg per day.

Health. Williams (1998) proposed improvements in health as an important contributor to the Flynn Effect. We used three indicators of health status of inhabitants of a given country, namely the under-five mortality rate (UNICEF estimates for the years 1990–2003), maternal mortality rate, and neonatal mortality rate (both WHO estimates for the year 2003).

Education. Barber (2005) (see also Ceci, 1991) suggested improvement in education as an important factor in the Flynn Effect. We used UNESCO data (averaged over the period 1970–2003) concerning gross enrollment ratio in secondary education, and estimates of teacher-to-student ratio.

Computers. The introduction of computers and computer games may have enhanced test-specific skills, contributing to the Flynn Effect (Greenfield, 1998). We use estimates of the number of computers per 1000 inhabitants over the period 1998–2002, provided by the International Telecommunication Union.

Family size. Zajonc and Mullally (1997) suggested that the trend towards smaller families partly caused the Flynn Effect. Fertility rate per country (averaged over 1970–2003) was retrieved from the World Development Index.

Urbanization. The transition from a rural to a (sub)urban society has also been suggested as a cause of the Flynn Effect (e.g., Dickens & Flynn, 2001; Schooler, 1998). Urbanization estimates for 2005 were retrieved from WHO tables.

Water quality. Poor water quality and sanitation may affect health, which may in turn affect cognitive development (Boivin, Giordani, Ndanga, Maky, et al., 1993). UNICEF provided estimates of the percentage per country of improved drinking water and sanitation in 2002.

Geographic distance traveled on foot. We chose as the cradle of mankind the Middle Awash archeological site in Ethiopia, with coordinates (10N, 40E). All distances to Australasia and the pacific were computed to go through Southeast Asia (33N, 73E), and all distances for the Americas were computed to go through the Bering Strait (65N, 169W). The coordinates of the countries' capital cities were used to compute distances in KMs under the assumption that the earth is a perfect sphere with radius of 3963 statute miles.

Ice-age temperatures. We computed mean averages for countries by correcting contemporary temperatures (from Lynn & Vanhanen, 2006) for approximate local air-surface temperature drops in countries during last glacial maximum (21,000 years ago), which were based on a map from the Paleoclimate Modelling Intercomparison Project.

9. Results

Table 1 contains the correlations between Lynn and Vanhanen's (2006) estimates of national IQ, the environmental variables, ice age temperature, and geographic distance. The correlations in Table 1 are highly multicollinear, as is evident from a very large first eigenvalue (see Fig. 1). All environmental variables correlate highly and significantly with each other ($p < 0.001$) and with national IQ ($p < 0.001$). The correlations with longitude and geographic distance are lower. A principal components analysis on these 18 variables resulted in one dominant principal component that explained 65% of the variance, and a second component that explained 12% of the variance. The Varimax rotated component matrix, given in Table 2 (the unrotated solution produced similar results), shows that the variables thought to play a role in the Flynn Effect all load on the first component, together with national IQ, temperature, and latitude. Longitude and geographic distance load on the second component. This first dominant component can be

Table 1
Correlations between estimates of national IQ with explanatory variables.

	Nat. IQ[a]-SSA	Nat. IQ	PC Rate/1000	Sec. educ. enrollment	Pupil–teacher ratio	Fertility	Urbanization	% Improved sanitation	% Improved water	Child mortality rate	Neonatal mortality rate	Maternal mortality rate	Calories/day per cap.	Proteins g/day per cap.	Fat g/day per cap.	Mean ann. temperature	Longitude	Latitude
PCs per 1000 persons	.697	.652																
Sec. educ. enrollment	.604	.776	.691															
Pupil–teacher ratio	−.429	−.767	−.520	−.785														
Fertility	−.752	−.851	−.650	−.868	.737													
Urbanization	.519	.593	.643	.701	−.560	−.635												
% Improved sanitation	.374	.717	.567	.829	−.818	−.768	.692											
% Improved water	.352	.690	.524	.792	−.734	−.732	.682	.875										
Child mortality rate	−.610	−.838	−.514	−.852	.788	.844	−.620	−.844	−.804									
Neonatal mortality rate	−.574	−.792	−.589	−.857	.761	.853	−.628	−.825	−.732	.930								
Maternal mortality rate	−.539	−.798	−.421	−.785	.726	.760	−.573	−.763	−.695	.926	.829							
Calories/day per cap.	.442	.694	.534	.755	−.702	−.709	.654	.751	.779	−.716	−.700	−.695						
Proteins g/day per cap.	.544	.753	.623	.805	−.744	−.771	.682	.770	.777	−.760	−.753	−.710	.937					
Fat g/day per cap.	.549	.683	.680	.810	−.707	−.757	.695	.800	.760	−.703	−.726	−.629	.874	.878				
Mean ann. temperature	−.541	−.617	−.639	−.726	.566	.696	−.481	−.499	−.500	.531	.541	.460	−.504	−.623	−.567			
Longitude	.017	.217	.041	.110	−.062	.082	−.138	.161	.117	−.184	−.187	−.191	.043	.017	.066	.202		
Latitude	.495	.599	.554	.764	−.573	−.695	.510	.616	.553	−.609	−.610	−.531	.566	.660	.650	−.869	−.074	
Geographic distance	.084	.345	.154	.218	−.160	−.238	−.043	.275	.185	−.304	−.305	−.308	.109	.081	.139	.064	.945	.075

Note: $N = 78$; All correlations $p < .01$, except for correlations that lie between −.263 and .263.
[a] Analyses without Sub-Saharan African countries ($N = 60$).

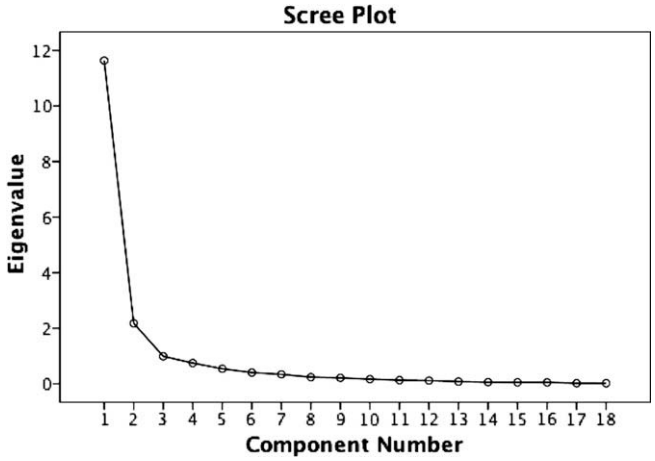

Fig. 1. Scree plot of principal components analyses of variables in Table 1.

interpreted as reflecting the developmental status of countries. The second component appears to be related to geographic location.

It is important to note that many of the correlations provided by Kanazawa, Templer & Arikawa, and Templer are driven by the low estimates of national IQ of countries in Sub-Saharan Africa. For instance, from the scatterplot given in Fig. 2, it can be seen that the correlation between national IQ and our geographic distance measure is driven by the low scores in Sub-Saharan African countries. In fact, analyses using only countries outside of sub-Saharan Africa provided results different to Kanazawa's: our distance measure and the three distance measures used by Kanazawa failed to correlate significantly with the national IQ outside of sub-Saharan Africa. Likewise, Templer's (2008) prediction from Rushton's theory that rates of HIV/AIDS per country correlate negatively with national IQ also does not hold outside Africa. The worldwide correlation ($N = 70$) changes from $r = -.635$ to $r = .060$ ($N = 54$) when the national IQs of sub-Saharan African countries are excluded. The first column of Table 1 contains the correlations with national IQ after excluding the sub-Saharan African countries.

The correlations in Table 1 indicate that environmental variables, hypothesized to have caused the Flynn Effect in the developed world, are also the variables that have yet to show improvements in developing countries with low national IQ, which are predominantly located in Sub-Saharan Africa. The strong relation between these environmental variables and estimates of average IQ per country shows that the supposed causes of the Flynn Effect are quite relevant to differences in national IQ. Clearly, one possible interpretation of the results in Table 1 is that national IQ is just another indicator of development. This suggests that improvements in environmental variables will result in higher national IQs.

Table 2
Varimax rotated component matrix of principal component analyses on variables in Table 1.

Variable	1st component	2nd component
National IQ	**.873**	.220
PCs per 1000 persons	**.713**	−.145
Sec. educ. enrollment	**.943**	−.017
Pupil–teacher ratio	**−.853**	−.049
Fertility	**−.910**	−.040
Urbanization	**.759**	−.203
% Improved sanitation	**.895**	.134
% Improved water	**.860**	.071
Child mortality rate	**−.908**	−.255
Neonatal mortality rate	**−.895**	−.197
Maternal mortality rate	**−.839**	−.281
Calories/day per capita	**.857**	−.069
Proteins g/day per cap.	**.905**	−.117
Fat g/day per cap.	**.878**	−.130
Mean ann. temperature	**−.716**	**.373**
Longitude	−.149	**.937**
Latitude	**.825**	**−.324**
Distance from Ethiopia	.205	**.860**

Note: $N = 78$.

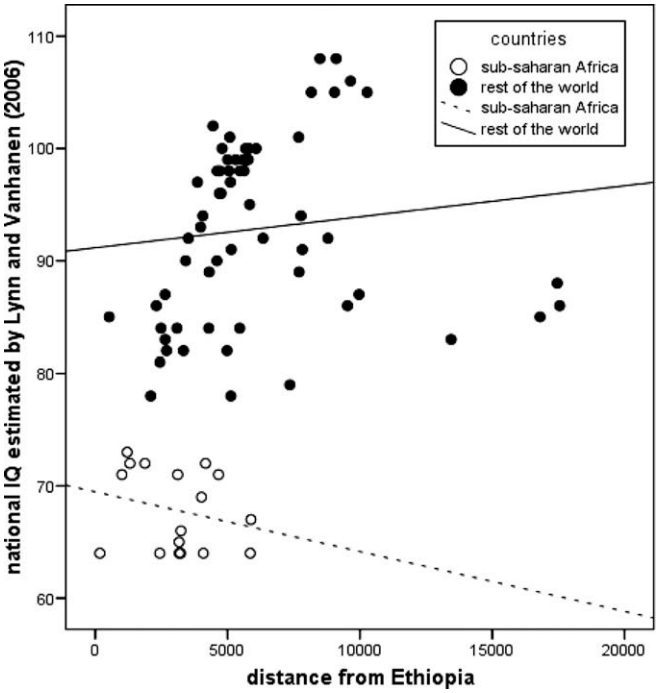

Fig. 2. Scatterplot showing that our geographic distance measure does not correlate with national IQ outside of Sub-Saharan Africa.

Naturally, alternative interpretations are possible as well, but this is precisely our point: causality, either of environmental or evolutionary variables, cannot be inferred from cross-sectional ecological correlations with national IQ without very strong prior knowledge of the processes that created these dependencies. Such knowledge is all but lacking. Therefore, the evidential support that national IQ studies yield concerning evolutionary theories cannot be considered "strong" (Kanazawa, 2008, p. 107). On the contrary, the evidence is weak at best, and irrelevant at worst.

10. Discussion

Evolutionary theories of race differences in intelligence are controversial. However, as scientists, we should be willing to accept a given theory, given sound scientific evidence that supports the theory and casts reasonable doubt on alternative theories. The problem with empirical tests of evolutionary theories of intelligence by Kanazawa (2008), Templer (2008), and Templer and Arikawa (2006) is that the data are not directly relevant to the evolutionary theory, because they lack the appropriate temporal perspective. Their empirical tests are unconvincing because they either fail to rule out alternative explanations, or use data that are subject to societal or temporal change. They make use of contemporary data that do not unequivocally speak to the last 60,000 years to which the theories pertain. Contemporary national IQs cannot, without cogent arguments, be taken to represent the general intelligence of people in prehistoric eras. Climate change renders the use of contemporary temperature in the study of evolution questionable. In addition, as we have shown, national IQ is hardly distinguishable

from other indicators of the developmental status of countries. Clearly, what is needed are studies that employ data that both rule out alternative explanations (e.g., Diamond, 1997) and that are relevant to the timing of differences within the evolutionary theories (e.g., MacEachern, 2006). We doubt whether national IQs can play much of a role in such studies. In addition, contemporary national boundaries do not reflect well the geography of human genes and (pre)historical gene flow. For instance, the current inhabitants of China are composed mainly of descendants of two Haplogroups that followed distinct routes under different climatic circumstances during the relevant evolutionary times. A comparison of these groups would be interesting for testing evolutionary theories related to climate, but China's national IQ would be quite useless in such a study.

The strong influence of national IQs in sub-Saharan Africa on correlations with national IQs is due in part to the unsystematic selection of studies in Lynn and Vanhanen that produced a downward bias of about 12 IQ-points in the estimates of national IQ of sub-Saharan African countries (Wicherts, 2007; Wicherts et al., in press). In addition, it is unknown whether the observed differences in IQ, even when corrected for this bias, are caused by differences in *g*. If this were the case, then we would expect measurement invariance (Millsap & Everson, 1993) to hold across different populations. In this connection, it is interesting to note that *g* cannot explain the Flynn Effect *within* countries over a time span as little as a few decades (Wicherts et al., 2004). If national IQs do not accurately reflect differences in average level of *g*, then the use of national IQs in tests of evolutionary theories of *g* is problematic.

Acknowledgements

The preparation of this article was supported by VENI Grant No. 451-07-016 awarded to Jelte Wicherts and VIDI Grant No. 451-03-068 awarded to Denny Borsboom from the Netherlands Organization for Scientific Research (NWO).

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