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Short Communication

Brain size as an explanation of national differences in IQ, longevity, and other life-history variables

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A R T I C L E I N F O

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A B S T R A C T

Brain size provides a causal mechanism for why national differences in intelligence correlate with life-history variables such as longevity, health, parental care, and fecundity. Brain size correlates .40 with general intelligence within human populations, .91 with IQ across ten human population groups, and .60–.90 with longevity, fecundity, and infant mortality in non-human animals (just as IQ does within and across nations, albeit often with lower values). Brain size is central to a suite of life-history variables arising during the course of evolution. Traits need to be harmonized, not work independently of each other. The question Wicherts et al. do not ask is – what causes national differences in their preferred theory of "developmental status?" Heritable brain-power is the answer. A life-history theory perspective on heritable brain-power also explains the social-class/longevity paradox within nations. Any theory which explains differences at the individual, national, and cross-national level deserves to be taken very seriously.

1. Introduction

Wicherts, Borsboom, and Dolan (2009) showed that even after excluding low scoring countries in sub-Saharan Africa, 60 national IQs correlated with latitude (.50), fertility (−.75), child mortality (−.61), education (.60), calories per day (.44), and urbanization (.52). They also found one dominant principal component that explained 65% of the variance across 18 variables. Wicherts et al.'s results corroborated those by Templer (2008), who found a super-factor accounted for 75% of the variance across 129 national differences in IQ, life expectancy, birth rate, infant mortality, HIV/AIDS, skin color, and GDP (median $r = .68$). Rushton and Templer (2009) extended these results showing that national IQs also predicted rates of violent crime such as murder, rape, and serious assault, albeit at a lower value (rs = −.25, −.29, and −.21, respectively; Ns = 113; Ps < .05). These studies in turn built on those by Lynn and Vanhanen (2006) who found national IQ correlated with life expectancy, $r = .82$; mother's mortality, $r = -.73$; infant mortality, $r = -.77$; national income, .68; adult literacy, .64; enrollment in higher education, .75; and democratization, .57.

However, Wicherts et al. (2009) concluded that even if correlations such as these are predicted by the life-history theory of race differences (Rushton, 1995), and by cold-winters and geographic novelty theories (Kanazawa, 2008; Lynn, 2006), it is problematic to infer evolutionary causality because other explanations are equally possible such as a country's "developmental status". They argue that an evolutionary basis for national IQs should only be inferred if "very strong prior knowledge of the processes that created the dependencies" existed, and such knowledge is "all but lacking". The question Wicherts et al. do not ask is – what causes national differences in "developmental status?" The answer is "brain-power" – a good proxy for which is a country's racial composition.

Dozens of studies from the 1840s to the present have found race differences in brain size, whether measured by MRI, endocranial volume, brain weight at autopsy, or external head size (with or without corrections for body size). Most were carried out on the three major races of East Asians, Europeans, and Africans. Averaging all the data, Rushton (1995) found: East Asians = 1364 cm^3; Whites = 1347; and Blacks = 1267. The overall mean for East Asians was 17 cm^3 more than for Whites and 97 cm^3 more than for Blacks. Since every cubic centimeter of brain tissue contains millions of brain cells and billions of synapses, the race differences in brain size help to explain the race differences in IQ. Jensen (1998, p. 443) calculated a correlation of .998 between IQ and cranial capacity for these three population groups.

For the ten major "genetic clusters", "population groups", or "races" studied by Lynn (2006), I have here calculated a .91 ($P < .01$) correlation between brain size and IQ. According to the IQ map of the world given by Lynn (2006, front matter), the East Asians (Chinese, Japanese and Koreans) obtained the highest mean IQ at 105, followed by Europeans (100), Inuit-Eskimos (90), South East Asians (90), Native American Indians (85), Pacific Islanders (85), South Asians and North Africans (85), sub-Saharan Africans

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(67), Australian Aborigines (62), and Kalahari Bushmen and Congo Pygmies (IQ 56). According to a brain size map of the world given by Beals, Smith, and Dodd (1984, p. 304, Fig. 3), based on their collation of 20,000 skull size measures. I estimated the mid-points of the ranges given for their cranial capacity measures and found, in (cm^3): East Asians (1425), Europeans (1375), Inuit-Eskimos (1440), South East Asians (1325), Native American Indians (1350), Pacific Islanders (1350), South Asians and North Africans (1325), sub-Saharan Africans (1275), Australian Aborigines (1225), and Kalahari Bushmen and Congo Pygmies (1200). I also calculated a correlation of .83 between brain size and IQ from the 10 brain size/IQ data sets given by Lynn using somewhat different samples and estimates (2006, p. 212, Table 16.2). I also calculated from that table the correlations between brain size and IQ and the winter temperatures for modern times as well as the most recent ice age, the Würm glaciation, which lasted from 28,000 to 10,000 years ago. The correlations all confirmed Lynn's and my hypotheses (−.79, −.80, −.56, −.60, respectively; $Ps < .05$).

Larger brains are capable of higher levels of intelligence because they contain more neurons and synapses and process information more efficiently (see Rushton & Ankney, 2009, for all the following brain size references). In 28 samples using brain imaging techniques, the mean brain size/IQ correlation is .40 ($N = 1389$; $P < 10^{-10}$); in 59 samples using external head size measures it is .20 ($N = 63{,}405$; $P < 10^{-10}$). Brain size is also highly heritable. A recent MRI study of 112 extended twin families found heritabilities of 82% for whole-brain gray matter volume, 87% for whole-brain white matter volume, 86% for IQ, and 100% for the relation *between* brain size and IQ. Other studies have found high heritabilities for specific brain components and connections, including myelin sheath (thicker myelin, faster nerve impulses). A functional relation between brain size and cognitive ability is also demonstrated by the correlation between brain size and IQ both *between* and *within* families (thereby controlling for social-class variables such as nutrition).

2. Brain size as part of *r–K* life-history theory

Metabolically, brain tissue is expensive. Representing only 2% of body mass, the brain uses about 5% of basal metabolic rate in rats, cats, and dogs, about 10% in rhesus monkeys and other primates, and about 20% in humans. Larger brains are also expensive in life-history trade-offs. They require more complex sequences of development and larger bodies to produce and sustain them. From an adaptationist perspective, unless large brains substantially contributed to evolutionary fitness (defined as increased survival of genes through successive generations), they would not have evolved. In the evolutionary competition to find and fill new niches, there is always "room at the top" for larger brains and greater behavioral complexity.

A basic law of evolution links brain size to what Wilson (1975) termed *r–K* life-history theory. This refers to a genetically organized group of traits that evolved together to meet the trials of life – survival, growth, and reproduction. The term *r* stands for the natural rate of reproduction (the number of offspring) and *K* stands for the amount of care parents give to insure that their offspring survive. Plants and animals have different life-histories. Some are more *r* and others more *K*, which are sometimes referred to as "fast" and "slow" life-histories, respectively, due to the different speeds of development they entail. *K*-strategists give their offspring a lot of care. They work together in getting food and shelter, help their kin, and have complex social systems. That is why *K*-strategists need more complex nervous systems and bigger brains but produce fewer eggs and sperm.

The bigger an animal's brain, the longer it takes to reach sexual maturity and the fewer offspring it produces. Oysters, for example, have a nervous system so simple they lack a true brain. To offset this they produce 500 million eggs a year. In contrast, chimpanzees have large brains but give birth to one baby about every four years. The number of offspring, time between births, the amount of care parents give, infant mortality, speed of maturity, life span, even social organization and altruism, all work together like pieces of a puzzle.

Rushton (2004) found empirical support for the predicted relationships between brain size and life-history variables. Across 234 mammalian species, brain weight correlated with longevity ($r = .70$), gestation time (.72), birth weight (.44), litter size (−.43), age at first mating (.63), duration of lactation (.62), body weight (.44), and body length (.54). Even after controlling for body weight and body length, brain size continued to predict the other variables ($r = .59$). Among a narrower range of 21 primate species, brain size still correlated .80–.90 with life span, length of gestation, age of weaning, age of eruption of first molar, age at complete dentition, age at sexual maturity, inter-birth interval, and body weight.

The races differ not only in average brain size and intelligence but also on a suite of 60 life-history characters. People of East Asian and African ancestry fall at two ends of a continuum, with Europeans falling intermediate in speed of maturation and longevity, personality and temperament, family stability and crime, and sexual behavior and fertility. Consider two-egg twinning, which is based on a double ovulation and leads to faster (typically non-twin) pregnancy. The tendency to produce dizygotic twins is heritable through the race of the mother and mediated by sex hormones. Around the world the rate of dizygotic twinning is: less than 4 per 1000 births among East Asians; 8 among Whites; 16 or greater among Blacks.

Another example: Black babies sit, crawl, walk, and put on their clothes earlier than do White or East Asian babies. The milestones for walking are: East Asians, 13 months; Whites, 12 months; Blacks, 11 months. Blacks also average an earlier age of sexual maturity than do Whites, who in turn have an earlier age than do East Asians, whether measured by age of first menstruation, first sexual experience, or first pregnancy. These racial-group differences are heritable: mixed-race children of Japanese-Black ancestry develop faster than do mixed-race Japanese-White children and especially than do children with two Japanese parents.

No non-evolutionary theory can explain all the variables in the three-step racial gradient. However, the *r–K* life-history perspective not only explains all the above relationships but also dovetails with the consensus view of human origins, "Out-of-Africa" theory. This posits that *Homo sapiens* arose in Africa about 150,000 years ago and then expanded northward beyond Africa about 100,000 years ago, with a European-East Asian split about 41,000 years ago. Evolutionary selection pressures were different in the hot savanna, where Africans lived, than in the cold northern regions Europeans experienced, or the even colder Arctic regions where East Asians evolved. Although Wicherts et al. (2009) argue that it was colder 60,000 years ago than it is today; nonetheless, it was always colder in more northerly latitudes (Bailey & Geary, 2009). Thus, the further north the ancestral populations migrated out of Africa, the more they encountered the more cognitively-demanding problems of gathering and storing food, gaining shelter, making clothes, and raising children successfully during prolonged winters. As these populations evolved into present-day East Asians and Europeans, the ecological pressures selected for larger brains, slower rates of maturation, and lower levels of sex hormone, and all the other life-history traits.

3. IQ and longevity

Since brain size is the best predictor of longevity across species, one of the more intriguing findings from Lynn and Vanhanen's (2006) compilation is the .82 correlation between national intelligence and longevity, which is higher than any other predictor variable including per capita income (.65), adult literacy (.71), and enrollment in tertiary education (.69). Many studies within countries have found IQ predicts mortality (Deary, Whalley, & Starr, 2009). For example, Čvorović, Rushton, and Tenjevic (2008) found a significant negative correlation ($r = -.26$; $P < .05$) between maternal IQ and child mortality among 222 Serbian Roma women (Gypsies of South Asian origin), even after adjusting for schooling, age, religion, number of marriages, age at first reproduction, and birth spacing. The most parsimonious explanation for the relationship between IQ and longevity lies in brain size and the robust constitution that accompanies it.

The life-history perspective suggests a resolution to the social-class/longevity paradox (Rushton, 2004). In spite of increased access to health care, the mortality gap between rich and poor is increasing rather than decreasing. In Britain from 1921 to 1971, everyone was living longer, but professional workers gained more years than semiskilled and unskilled workers. In 1930, people with the lowest SES had a 23% higher chance of dying at every age than people with the highest SES. By 1970, this excess had grown to 61%. A decade later it had jumped to 150%. In Britain, National Health Service has long minimized inequalities in access to medical care. The increasing correlation of health and SES can be understood as the result of removing environmental impediments causing individual differences to become more dependent on heritable characteristics.

4. Conclusion

Central to answering the question of why nations differ in IQ, longevity, crime, and economic "developmental status", is heritable brain-power that evolved in part as a response to natural selection in the colder northern latitudes.

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