Title: The geography of tyranny and despair: Development indicators and the hypothesis of genetic inevitability of national inequality.

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Abstract

Development geography has long sought to understand why inequalities exist and the best ways to address them. Dependency theory sets out an historical rationale for under-development, based on colonialism and a legacy of developed core and under-developed periphery. Race is relevant in this theory only in so far that Europeans are white and the places they colonised were occupied by people with darker skin colour. There are no innate biological reasons why it happened in that order. However, a new theory for national inequalities proposed by Lynn and Vanhanen in series of publications makes the case that poorer countries have that status because of a poorer genetic stock rather than an accident of history. They argue that IQ has a genetic basis and IQ is linked to ability. Thus races with a poorer IQ have less ability, and thus national IQ can be positively correlated with performance as measured by an indicator like GDP/capita. Their thesis is one of despair as little can be done to significantly improve genetic stock other than a programme of eugenics. This paper summarises and critiques the Lynn and Vanhanen hypothesis and the assumptions upon which it is based, and uses this analysis to show how a human desire to simplify in order to manage can be dangerous in development geography. While the attention may naturally be focussed on the 'national IQ' variables as a proxy measure of 'innate ability', the assumption of GDP/capita as an indicator of 'success' and 'achievement' is far more readily accepted without criticism. The paper makes the case that the current vogue for indicators, indices and cause-effect can be tyrannical.

Keywords: Indicators, indices, IQ, GDP

Introduction

At the turn of the century two researchers – Richard Lynn (of the University of Ulster, UK) and Tatu Vanhanen (of the University of Tampere, Tampere, Finland) – employed an old hypothesis to explain the differences we see in the relative wealth of nations. They originally presented their case in a book entitled *'IQ and the wealth of nations*' (Lynn and Vanhanen, 2002) and have recently restated their case in a book entitled '*IQ and global inequality*' (Lynn and Vanhanen, 2006). As the titles of both books suggest their hypothesis is that the differences we see today between national states in terms of the wealth can be explained by the IQ of their respective populations. They claim that a population's IQ is linked to a sense of innate ability which in turn is translated into economic performance. The causal chain is simple: the higher the national IQ then the greater the innate ability of the population and the better the economic performance. Their thesis is a more basic form of the well-established causal chain that education, as expressed in better literacy for example, can contribute to economic productivity and competitiveness (OECD, 1995; Lewis, 1997), but they go much deeper. Thus arguments geographers often employ to explain differences in wealth, for example as a consequence of historical factors (dependency theory) or a forcing of one perspective of 'development' on the rest of the world (post-development), are wrong. Lynn and Vanhanen argue that we see today is an inevitable consequence of the quality of the human stock that inhabit

those places, and even the post-Second World War emphasis on modernisation is doomed to failure. After all, as national inequality is, they claim, to a large extent genetically predetermined then attempts to address inequality can only be achieved by boosting national IQs.

The Lynn and Vanhanen hypothesis is not a new one. It is the latest chapter of an old story founded on an assumption that races differ in terms of their intelligence and this in turn is reflected in differences in the degree to which societies are 'developed'. Both books have been well-received by some:

"This is a book that social scientists, policy experts, and global investment analysts cannot afford to ignore. It is one of the most brilliantly clarifying books this reviewer has ever read."

Rushton (2003). In a review of Lynn and Vanhanen (2002)

"In their new book Lynn and Vanhanen have convincingly refuted those critics who asserted that their national IQs lack reliability and validity. For economics, they have made what is arguably the most important contribution to economic understanding since Adam Smith showed that free markets promote economic development. They have also shown that national IQs explain much of the variation between nations in a wide range of economic and social phenomena. Their book extends the explanatory power of the concept of intelligence in a way that makes a major contribution to the integration of psychology with the other social sciences."

Rushton (2006). In a review of Lynn and Vanhanen (2006)

While others have been far less charitable:

"This is not so much science, then, as a social crusade…..this is a blast from another age, an old-fashioned attempt to give an imperial mindset biological validity"
Richardson (2004; page 360). In a review of Lynn and Vanhanen (2002).

Biology has been down this road of genetic determinism of human intelligence and behaviour many times, including the so-called Social Darwinism of the 19th Century (Claeys, 2000) and the more recent rise of socio-biology in the 1980s (Wilson, 2000). Social Darwinism is a term often employed in the 20th Century to describe the maelstrom of ideas which hypothesised superiority of one race (often white skinned and colonisers) over others (often brown skinned and colonised). As the term implies, it illustrates the notion of 'survival of the fittest' arising from a natural selection founded on competition. Indeed Claeys (2000) makes an interesting, and under-explored, link between the origins of Social Darwinsim and emerging concepts of political economy arising out of Adam Smith's *Wealth of Nations* (1776) and the logic of "fit nations" able to maintain a competitive edge; early echoes of the Lynn and Vanhanen hypothesis. Socio-biology sought to explain animal behaviour in terms of propagation of genes rather than individuals. Thus altruism in insects, for example, which may seem counter-intuitive at a superficial level (what would the individuals possibly gain?), could be readily explained as within such species individuals are genetically identical. Thus altruism could be

explained as genes helping other identical genes to survive and multiply. The individual might die but her genes were the same as those of the breeding members of the population and thus altruism makes biological sense. Genes were postulated to explain certain behaviours in animals in much the same way that they can influence physical characteristics, and thus these behaviours are open to exactly the same process of natural selection. But proponents went further and extended their ideas into the complexities of human society and culture, hoping to explain variation in sexuality, criminality, creativity and intelligence amongst others. While the basis of the reasoning may be different the underlying process of "survival of the fittest" pervades the argument and this caused much debate at the time, with one of its originators even being attacked during public meetings. Separating nature from nurture in humans has always been contentious.

By way of contrast, the geography literature has been surprisingly silent on the Lynn and Vanhanen hypothesis. Are there not lessons for us engaged in development geography that can be gleaned from such extreme attempts to simplify in order to understand? The paper will explore this question by using the Lynn and Vanhanen hypothesis as an archetype of what can happen with such efforts. The paper will first present the chain of reasoning behind the Lynn and Vanhanen hypothesis and illustrate the serious flaws that rest behind it. This is an important issue which deserves to be brought into the light of geographical discourse. But also of importance is how the Lynn and Vanhanen hypothesis is symptomatic of a much wider and yet far less apparent problem in development geography – the potential tyranny of indicators.

IQ and race

The history of efforts to identify a genetic basis for IQ is a long and interesting one, and has a distinctly British influence. Sir Francis Galton (1822 - 1911), a cousin of Charles Darwin, is often regarded as the first person to statistically explore the heritability of human intelligence. Galton had a remarkable intellect and the invention of tools routinely employed in human geography today (questionnaires, standard deviation, regression and correlation) are often attributed to him. He also coined the term eugenics and encouraged selective marriages to help enhance the genetic stock of any offspring. Carl (Karl) Pearson (1857 – 1936) who helped found the science of mathematical statistics was the first holder of the Galton Chair of Eugenics at University College London. He made many contributions to statistics, and Person's Chi-square test is widely used. Although a socialist he advocated competitive struggle (war even) between superior and inferior races as a means of improving the human stock. Another statistician heavily influenced by the work of Galton on the heritability of intelligence, Charles Spearman (1863 – 1945), helped develop an important technique which is now widely employed in statistics – factor analysis. Spearman began with the reasonable assumption that students doing well in one exam (geography for example) were also likely to do well in another (such as maths). Hence a set of test scores for a group of students in a range of subjects were likely to be positively correlated using the statistical technique invented by Galton and further developed by Pearson. The same applies to performance on various types of intelligence test. Using these correlation coefficients it is possible to extract principal

components; mathematical expressions of an underlying relationship (Spearman, 1904, 1927). Using factor analysis it can be shown that approximately 40% of the variation in intelligence test results can be explained by a vector (usually referred to as general intelligence or general cognitive ability; 'g'). Much of the modern, often quite heated, discourse surrounding a genetic basis for IQ is founded on this concept of 'g' (Jensen, 1998).

As 'g' emerges as a principal component in factor analysis it should be remembered that it is first and foremost a mathematical construct. After all, no matter how good the mathematical theory upon which it is based a statistically significant correlation coefficient does not necessarily imply a causal relationship. Even so, there have been attempts to see 'g' as a statistical indicator of something physical. Indeed the current thinking is that 'g' reflects a biological basis (Brody, 1998, 1999), with some even pointing to a specific site for 'g' within the brain (Duncan et al, 2000). It is correlated with a range of biological variables such as frontal grey matter volume of the brain (Thompson et al, 2001), although others suggest that the physical basis for 'g' may be spread around the brain (Colom et al., 2006), and brain size or volume (Wickett et al., 2000; Posthuma et al., 2002) although this is disputed (Schoenemann et al., 2000). It has recently been suggested that 'g' is related to 'working memory capacity' suggesting that the physical basis for the two in the brain may be shared (Colom et al., 2007) even if they are not the same thing (Conway et al., 2003). If it has a biological basis then it may be genetically determined, if only in part, but empirical evidence for such a chain of reasoning has been elusive. If there is a genetic basis for 'g' (i.e. it is heritable), and some

certainly claim that this is proven (Toga and Thompson, 2005), then despite the powerful techniques currently available it has not yet been possible to identify the genes involved (Plomkin, 2001).

A biological and genetic basis for 'g' implies that differences in general intelligence may exist not only between individuals but between groups which have some genetic difference such as those based on sex and race. Many have looked for such differences since the 19th century, well before 'g' emerged from statistical analysis (Gould, 1996). Attempts to show that 'g' is higher in males than females continues to this day (Lynn and Irwin, 2008), and is claimed to be related to the larger brain sizes of males relative to females (Colom and Lynn, 2004). While within race variation in IQ is acknowledged to be much greater than variation between races (Spearman, 1927; Brody, 1998) results have implied a hierarch: Asians perform best followed by Europeans with those of African origin performing the worst (Lynn, 1996; Rushton, 1997; Rushton and Jensen, 2005). Rushton (2001) has argued that these differences in rank order can be found for different races living within the same country. Indeed, given the chain of assumption that genes are partly involved in determining 'g', and hence there are differences between individuals and groups, then this does present a challenge that strikes at the very heart of human geography as we know it today. As two of the main players in this field have stated:

"A prevailing worldview throughout history has been that economic, cultural, and other environmental forces are the pre-eminent causes of group and individual behavior. Modern social science has typically taken this perspective and promoted the idea that all

babies are born more or less equally endowed in intelligence and learning ability. It followed therefore that inequalities were the result of social, economic, and political forces. This worldview generated many strategies for intervention in the home, the workplace, the mass media, the criminal justice system, and even the entire social–economic system. Some have been effective and are almost universally accepted, whereas others have failed and produced only shattered expectations, resentment, and interethnic hostility."

Rushton and Jensen (2005; page 284)

It is, of course, but a small step from 'proof' of cause-effect to suggest policy interventions that could enhance 'g' within a population. After all, individuals with low 'g' may be relatively unproductive and thus poor and may even have to be supported by the state. There are indeed historical examples of immigration and educational policy based on assumptions of a difference in general intelligence between races (Gould, 1996; Schönemann, 1997), and there are others who have advocated a modification of social welfare systems to discourage births amongst poor women who are assumed to be low in 'g' (Herrnstein and Murray, 1994). Even if 'g' does exist as a physical and heritable entity some have questioned the dangers of over-simplification which can arise given that so many other factors are important (Bowman et al., 2001). However, predictably this simple causal chain of reasoning:

genes → brain size/function → assessed as 'g' → ability → socio-economic performance → policies to enhance 'g' in a population

allied with an assumption that races differ in 'g' and resulting policy implications, such as curbing immigration, have been popular calls amongst extreme right-wing groups. It is within this maelstrom that the Lynn and Vanhanen thesis has emerged to explain reasons for the inequalities that rest at the heart of development geography, and their message has not been lost on some groups.

There have been numerous efforts to counter the simple causal chain, and a paper such as this cannot hope to cover all of the ground covered in this substantial, vigorous and often heated debate. The interested reader is referred to Modgil and Modgil (1987), Sternberg (1987), Commentary (1995), Gould (1996), Brand (1996), Schönemann (1987, 1997) and Miele (2003) for a taste. For example, Dr Chris Brand's 1996 book, 'The g Factor', which made a case for racial difference in intelligence was de-published by Wiley although it did appear on the internet and can be downloaded from his website. Brand was dismissed from his post at the University of Edinburgh in 1997. The recent suspension of Dr Frank Ellis, from the University of Leeds for supporting the notion that the 'white' race was more intelligent than the 'black' race is another example that made headlines in the UK. Looking for racial differences in IQ by employing intelligence tests raises the question as to whether the results simply reflect the fact that most of the IQ tests have been designed by 'white' races (Gould, 1996; Rutter, 2003). But 'race' is a constructed term, both socially and culturally (White, 2002; Richardson, 2004; Kothari,

2006), so what does ‘Asian’ and ‘European’ or indeed ‘black’ and ‘white’ mean? It must first be said that ‘race’ is a concept which does have relevance in development (White, 2002; Kothari, 2006) given the history of colonialism which has influenced relationships between much of the poor and rich parts of the globe. As a result Kothari (2006: 6) argues that “*Race is fundamental in not only explaining how the modern world system emerged but also how it functions in localized and globalized relationships*”. In biological terms ‘race’ is also contested given that intra-racial genetic variation is often greater than inter-racial variation (85% vs 15% respectively according to Lewontin, 1972), although some do argue that ‘race’ in humans has a genetic relevance (Edwards, 2003). Also, to what extent is IQ malleable and influenced by environment to produce what one measures as ‘intelligence’ with tests (Brody, 1998, 1999; Garlick, 2002)? Indeed, ‘intelligence’ is not fixed throughout an individual’s lifetime and the influence of the ‘environment’, especially education, is still unclear (Jensen, 1980; Brody, 1998, 1999; Myerson et al., 1998). Garlick (2002) has argued that schooling can influence performance on IQ tests and this may explain the so-called Flynn effect where performance on such tests has been shown to improve with time (Flynn, 1987). The degree to which learning influences performance on IQ tests has also been the subject of much discussion (e.g. Jensen, 1980) with some pointing out that schooling can increase IQ performance (Garlick, 2002) and this may partly cause the gradual increase in intelligence as measured by IQ tests that one has seen for all races over time (Flynn, 1987). Therefore it is perhaps unsurprising that a recent editorial summary of all the evidence suggests that the case for a heritability (hence genetic) factor to ‘g’ when

compared with these other influences is still far from being proven (Ceci and Williams, 2007).

The IQ and economic development hypothesis: The case for

In their original book Lynn and Vanhanen (2002) base their argument on a regression between national IQ (determined as an average of tests applied to samples of individuals) as the independent variable against a suit of economic indicators such as GDP/capita as the dependent variable for groups of 81 (Chapter 7) and 185 (Chapter 8) countries. Their 2001 paper summarises the results from Chapter 7 of the book for the 81 countries. While GDP/capita and its ilk may be problematic as a measure of 'development' and is not without its problems as a measure of economic activity it does have a solid foundation in theory. In their latest analysis (Lynn and Vanhanen, 2006) present a new dataset of measured IQs for 113 countries and estimates for a further 79 countries, and regress them against a broad suit of economic and development indicators that are well-known in development geography including the Human Development Index (HDI), Gender Related Development Index (GDI), economic growth rate, Gini Index (measures inequality of income or resources), Headcount Ratio (proportion of population below the $2/day poverty line) and Transparency International's Corruption Perception Index (CPI). Such indices are fashionable, representing as they do attempts to compress the complexity of reality into single numbers as a guide to policy and management (Morse, 2004). However, for the purposes of this paper the focus will be upon the case they made in their

2002 publication as that is more clearly focussed on economic indicators as a measure of 'output'. Indeed some of the indices they employ in their 2006 book such as the HDI and GDI have GDP/capita as a component.

The reader can find all of the Lynn and Vanhanen methodological details in their 2002 book (and summarised in their 2001 paper) and need not be repeated here, although it is necessary to highlight some of the assumptions. The national IQ data are based on published test results spanning a period of 70 years, and adjusted relative to a value for Britain of '100' and a standard deviation of 15. The data have also been adjusted for 'IQ inflation' (The Flynn Effect) of 2.5 points a decade since the 1930s. One of the problems with this approach rests with the extrapolation of relatively small samples (referred to by Richardson, 2004, as "*motley tests*") to 'national IQ'. Just how representative are the results of such tests, often of individuals within a narrow age range? This is a criticism that Lynn and Vanhanen are well aware of and they have tried to deal with it by triangulating the IQ results against other parameters which they see as related to IQ. For example, Lynn and Vanhanen argue in their first book that their national IQ data correlate well with national scores in mathematics ($r = 0.9$ $N = 30$ $P<0.001$) and science ($r = 0.878$ $N = 30$ $P<0.001$) that are available, and recent work has attempted to reinforce and refine the link (Lynn and Mikk, 2007). Not all countries have samples of IQ tests that can be drawn upon to derive a national value, and Lynn and Vanhanen close some of these gaps by extrapolating from the results for neighbouring countries. Thus the national IQ for Afghanistan (83) was found by averaging the values for India (81) and Iran (84) and

rounding up. This is, of course, a process of self-reinforcement; apparently 'new' data created for an Asian country by using the results from other Asian countries.

Lynn and Vanhanen proceed from here to regress national IQ against GDP/capita and the results based on a sample of 139 countries out of their 185 are shown as Figure 1. The rationale for selecting 139 will be discussed later. There are some differences between Figure 1 and the graphs employed by Lynn and Vanhanen (2001, 2002). While the IQ data are the same the dependent variable is GDP/capita for 2004 (taken from the UNDP Human Development Report for 2006) rather than that of 1998. Also, in order to help make the case as strong as possible the logarithm (base e) values of GDP/capita have been employed in Figure 1, while in their own publications they have employed the raw GDP/capita data. The R^2 in Figure 1 is 58% while the equivalent R^2 in the Lynn and Vanhanen (2002) book (page 142) based on data for 185 countries is 39%.

Given the statistical significance of the relationship in Figure 1 the authors would conclude an unambiguous cause-effect with national IQ said to be a main factor (not the only one) in the determination of economic development as measured by GDP/capita. They theorise that IQ measures an innate ability and the higher the IQ then the higher the ability and this becomes reflected in better national performance as measured by GDP/capita. Once a causal chain between IQ and economic performance is assumed to be 'proven' it is but a short step to consider the repercussions for policy. On page 195 of their 2002 book we have:

"*Because of the evidence we have assembled for a causal relationship between national IQs and economic disparities, it has to be accepted that there will inevitably be a continuation of economic inequalities between nations. Intelligence differences between nations will be impossible to eradicate because they have a genetic basis and have evolved over the course of tens of thousands of years*."

Seems like all we can do is despair and hope that 'outlier' countries that have yet to reach their economic potential as predicated by IQ can be helped to do so.

The Lynn and Vanhanen hypothesis has been adapted by others. Templer and Arikawa (2006) for example include climate, notably temperature, in their analysis of the Lynn and Vanhanen national IQ dataset. They conclude that mean temperature is negatively correlated with national IQ. Kanazawa (2006) and McDaniel (2006) attempt a Lynn and Vanhanen type of exercise for states of the US, arguing that the same logic should hold at more micro scales. While there are no uniform state level tests of IQ they do find weak positive correlations between performance on the Scholastic Aptitude Test (SAT), ACT and a composite of the two (SAT and ACT are college entrance exams) and state wealth. However, given the patchiness of the use of ACT and SAT across the States and the difficulty of arriving at a common denominator for IQ the work was inconclusive.

While the Lynn and Vanhanen (2002) case looks at national differences there is an overt linkage to race. But what do the IQ test results of Lynn and Vanhanen say about 'racial' difference? Employing dummy variables for 'Europe', 'North America and Australia',

'Asia' and 'Latin America and the Caribbean' for a sample of 152 countries in the Lynn and Vanhanen (2002) dataset it is possible to arrive at the regression analysis shown in Table 1 with national IQ (Africa is the baseline). The regression is highly significant with an R^2 of approximately 75%. All four slopes are positive with respect to Africa, with Europe and the 'North America and Australia' categories having the greatest value suggesting that its here that the highest IQs are to be found. Latin America and the Caribbean as well as Asia do relatively poorly. The mix of results shown here is generally explained by Lynn and Vanhanen as being a function of racial differences (e.g. whites have a higher IQ than blacks), with some of the error caused by immigration. Hence some countries such as the US have their IQ depressed "*because of the substantial numbers in the population of blacks and Hispanics*" (page 62). Note that they employ these regions as crude proxies for 'race'.

The IQ and economic development hypothesis: The case against

The central dilemma of the Lynn and Vanhanen case rests with their assumption that national IQ data are primarily (not wholly) a function of innate ability which in turn is at least partly generated by genes. There are many assumptions of cause – effect in here, and some of them involve substantial leaps of faith. The first, that there are genetic differences between human races, is perhaps the least contentious but even here the terms can be loose and there are disputes given the levels of intra-racial genetic variation. On a more substantive note there are problems with labels. For example, it is possible to look

at differences in IQ between countries having English, French, Spanish and Arabic as their official language. This will cut across the regional divisions and presumably also the racial divisions employed by Lynn and Vanhanen (2002). The results for the same countries included in Table 1 are shown as Table 2 (regression with dummies used for language). The comparison here is against countries not having one of those four languages as its official language. The findings suggest that those countries having French, Arabic or English as their 'official' languages have significantly lower IQs than those that don't! Remember that this is exactly the same data set as used for Table 1, but the countries have been classified in a different way. Admittedly the R^2 is lower but the model is still statistically significant.

Secondly, as has already been discussed, the extent to which 'g' is physical and genetically determined (heritable) is open to much contention. The problem can be illustrated by looking at a simple measure which we do know to be strongly inherited – height. But even here it is widely acknowledged that environmental factors such as nutrition can have a major influence. If height is highly heritable and yet also open to environmental influence then what of 'g'? The case is not proven and if better schooling gives higher IQs, and more wealth brings better education systems, then the neat cause-effect assumption of Lynn and Vanhanen breaks down.

Thirdly, GDP is a measure of monetary flow in an economy, and is not without its problems even when adjusted for purchasing power parity. For example, it does not include 'unregistered' flows of money such as through the black market or systems where

no records are kept, and the latter can be of especial importance in markets of developing countries. However, in addition to these points it should be noted that economic performance as measured with the suite of indicators employed by Lynn and Vanhanen (2002) can be driven by many factors, including the endowment of valuable natural resources, politics, proximity to well-performing economies etc. This could, of course, be claimed to contribute to error variation in the Lynn and Vanhanen model so that at some similar levels of national IQ there is a wide variation in GDP/capita. For example there are 11 countries having a national IQ of 72. They are mostly African countries (Botswana, Chad, Jamaica, Kenya, Lesotho, Mozambique, Namibia, South Africa, Sudan, Swaziland and Tanzania), but they span $\log_e$ GDP/capita values from 6.51 (~ $672/capita) to 9.32 (~ $11,159/capita). Indeed, an illustration of the dangers of a cause-effect assumption with IQ and GDP/capita can be demonstrated by taking another theoretical 'effect' besides GDP/capita at the national level of IQ. Rather than select any of the development indices/indicators in the Lynn and Vanmhanen (2006) publication I have selected the number of journal publications published by authors having a postal address in the country adjusted for the population of that country (number of articles per million population). There are three main reasons for selecting this variable as a measure of 'success':

1. the readership of this paper will largely comprise academics and this community is only too aware of the importance of journal articles as a measure of their individual and departmental 'success'. It is thus an indicator that has an especial resonance with that group.

2. journal paper ‘success’ does form the basis for national and institutional policy judgments in a number of countries such as the UK with its Research Assessment Exercise (RAE) and even more so with its proposed successor, the Research Excellence Framework (REF) . Hence this is certainly not a novel or untried variable with which to measure ‘success’. An example is provided in the House of Commons Science and Technology Committee report of 2004-05 (page 11) where the drop in the UK’s share of global publications is bemoaned and blamed in part on developing countries increasing their output.
3. Data on the number of published articles per country can easily be gleaned from the Web of Science service (Thomson Scientific; scientific.thomson.com).

The methodology employed is admittedly crude in that it allocates an article to each of the countries represented in a multi-authored paper. If say four authors are from the UK then that paper appears as a single count under ‘UK’, but if one each is from the UK, USA, France and Germany then all four countries received a ‘count’. Thus the data may bias in favour of multi-authored multi-country articles. Also there is no weighting for the numbers of citations generated by a paper. A paper with no citations in the literature would be counted the same as one having hundreds. Recent proposals to employ publications as a measure of research ‘quality’, such as REF in the UK, are citation based rather than simply counting the number of papers. However, even with these limitations the results are illuminating. A plot of the number of journal articles published in 2004 per million head of national population against the national IQ data of Lynn and Vanhanen (2002) for the same 139 countries employed in Figure 1 is presented as Figure 2.

Countries with no papers published in 2004 and the USA with a very high count have been omitted from the sample. It should be noted that while the distribution of the data points suggests heteroscedasticity this has been ignored. The regression is statistically significant (log number of articles per million people has been employed) with an R^2 of 50% which is admittedly lower than in Figure 1 but is still reasonable and compares well with many of the R^2 in Lynn and Vanhanen (2002). The relationship would seem to have a similar superficial logic to the GDP/capita and IQ argument. After all, a higher IQ (innate ability) for a population would presumably result in a better quality of personnel at university and research institutes and hence an enhanced ability to compete for publication space in journals.

As with the Lynn and Vanhanen hypothesis founded on GDP/capita there are many problems with the assumption that number of publications is a valid measure of output. After all, the higher education workforce is very mobile and a university may have a significant proportion of its academic staff from all over the world even if the majority are from the country in which the institution is based. There are also policy interventions to consider. The RAE employed in the UK till 2008 as a form of accountability encourages academics to publish even if they only have to submit four articles for scrutiny every 5 or 6 years. One would expect given this inducement that the UK would have a relatively higher publication rate for its national IQ, and a cursory glance at the data suggests that this is indeed so. Of the five countries having national IQ values of 100 the UK has 1,219 articles per million of population compared to 1,200 for Singapore, 1,117 for New Zealand, 1,093 for Belgium and 41 for China. The ‘article’ indicator is

also a function of GDP/capita as shown in Figure 3. A significant relationship between these two may well have been expected given that both are statistically related to national IQ, but here the adjusted R^2 is the best of all three at 76%. Again, the relationship is logical as greater national wealth leads to more expenditure on universities etc. in the form of better salaries to attract the best researchers and good facilities. Indeed given the 'messiness' of both GDP/capita and my 'articles' indicator it is frankly surprising that the R^2 is as good as it is. It would suggest that the article indicator is dominated at global scales by national wealth, and policy tools such as the RAE may appear to be of only secondary importance. Table 3 is a list of the top 20 countries in terms of GDP/capita along with their observed values of the article indicator, their predicted values and residuals (observed – predicted) derived from the equation in Figure 3. While the RAE as a policy instrument may be reasonably argued to give the UK a positive and healthy residual of +0.7668 relative to competitors such as Germany and France this residual is in fact less than that of a number of countries not having an RAE-style policy in place. Still without picking apart the data too much the point remains that if national wealth is seen as a driver of the articles indicator rather than the other way around, then it seems reasonable to think of the IQ variable as also being driven by wealth via education rather than the reverse.

Discussion

The Lynn and Vanhanen hypothesis, for all of its flaws, has had remarkably little exposure in the development geography literature, and this is dangerous. The ideas of

Lynn and Vanhanen are presented as science, and like all scientific endeavour the hypotheses stand or fall by the evidence and should be challenged in those terms. IQ tests and indeed GDP are constructs of human beings; 'intelligence' can be defined by IQ (and 'g') just as 'progress' can be defined by GDP or indeed HDI. In this paper I have also employed the number of published articles per head of population as a measure of 'success' in knowledge production and that too is positively correlated with IQ and indeed with GDP/capita. But it is the old argument in correlation of what is influencing what? It seems logical to imagine publication output being simply a function of GDP/capita and hence investment in researchers and infrastructure although wealth can also be driven by investment in research. Similarly an assumption that innate ability as measured by IQ is the driving force behind wealth would appear to ignore the possibility that IQ could also be a function of wealth via investment in education. Intelligence tests have existed for a long time and analyses of the extensive data do consistently suggest that a 'g' exists. There is also growing evidence to suggest that it may have a physical basis within the brain, even if it can't be pinned down to a specific location. But there is clearly much complexity to all this considering the 'environmental' influence on 'g' and the dangers of over-simplification when comparing groups is immense (Gould 1996; Flynn, 2003).

So why as development geographers should we bother with such things? Explaining inequality at all spatial scales is our most central goal, and it may be argued that while the Lynn and Vanhanen hypothesis may be an extreme example of searching for a simple way of explaining social inequality (blame it on the genes) it is nonetheless symptomatic

of a wider trend that we have seen in development geography; the continuous attraction of simple explanations for complexity or, put another way, the quick fix. The dilemma is that we focus almost entirely on one of the scales of the Lynn and Vanhanen hypothesis – IQ and its presumed link to race – as being the most contentious, even offensive, and this is understandable. We can pour through the arguments for this as I have done here, and most would find the evidence inconclusive at best. Hence the IQ-race relationship is readily rejected. Scientific racism as a theory for explaining difference is far from being dead and deserves to be challenged, not least by geographers.

But there is much more to Figure 1 than a debunking of the attempt to relate national IQ, race and performance. This may be the dimension that catches the eye, but we all too often forget that the other axis in the graph with its assumption that GDP/capita is a measure of progress or achievement is also deeply contentious but on this occasion is hidden by the fashion for the use for such measures. We live in a world of indicators and indices which try to compress complex information into single numbers or maybe a group of few dozen (Morse, 2006). This is done to help measure the influence of policy or, put simply of all, to help 'mangers to manage', but the richness of human existence and well-being becomes compressed into a few numbers. The past 30 years have seen a huge growth in the creation and promotion of indicators and indices, and Lynn and Vanhanen adopt some of them as dependent variables in their 2006 book. A survey undertaken by the UNDP cataloguing indices intended to measure country performance and behaviour suggest that in the 1970s there were less than 10 such indices whereas by 2005 there were more than 120, with some 80% of the total appearing in the period 1991 to 2005

(Bandura, 2005). This is something of a boom industry and once indices have been created it is tempting to work in the Lynn and Vanhanen style of regressing them against other explanatory variables, but it is also easy to lose sight of the simplifying and value-led assumptions which rest behind the creation of the HDI, GDI, CPI etc. (Morse, 2004). The danger is that the indices/indicators become the vision rather than being seen as limited transects into richness. This is also not to say that GDP/capita is any better or worse compared to any index which could be created. These are value judgements, not science, and any indicator or index will, by definition, be a mere shadow of reality.

We constantly need to make sense of the world and 'consilience', a term coined by the biologist Edward O. Wilson, rests on a "*conviction, far deeper than a mere working proposition, that the world is orderly and can be explained by a small number of natural laws*". In effect, he argues:

"*We are drowning in information, while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information at the right time, think critically about it, and make important choices wisely*".
Wilson (1998: page v)

Wilson's goal is to apply consilience as almost another form of reductionism to make sense of the world. A desire for consilience explains the demand for indicators/indices and the drive for cause-effect explanations based on simple regressions; hence the extrapolation from these cause-effect 'facts' to policy. Ironically for the story presented

here Wilson was the originator of sociobiology with its goal of explaining animal behaviour patterns with genes (Wilson, 2000). His extension of this theory to human behaviour is arguably a form of structuralism where genetic deterministic forces act on the behaviour of the individual (Rindos, 1986).

The world today is one where the demand for consilience, primarily perhaps amongst those wanting to manage, pushes against the complexity which constantly emerges from 'postist' schools of thought in human geography (post-modern, post-structural) which stress the importance of multifaceted interpretation of self and society. To me the danger of the Lynn and Vanhanen hypothesis is two-fold. Poor science all too easily highlighted by the assumptions made of IQ and its supposed link to race is the most obvious and easily decried element of the exercise; it's the one that holds the attention and calls out to be challenged. But their model also illustrates an assumption that is all too pernicious and hidden – the potential tyranny of indicators and indices in development geography.

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Table 1. Link between the results of IQ tests and global regions

Dependent variable is the national IQ test data of Lynn and Vanhanen (2002)

Independent variables are dummy values for region (Africa given a value of zero).

	N	Coefficient (SE)	T-value
Intercept		70.96 (0.86)	82.2 ***
Europe	36	25.93 (1.3)	20.0 ***
North America and Australia	4	27.3 (3.02)	9.03 ***
Asia	43	17.0 (1.24)	13.8 ***
Latin America and the Caribbean	24	13.71 (1.46)	9.4 ***

R^2 (adjusted = 74.6%

F = 112.11 *** (df = 4, 147)

Table 2. Link between the results of IQ tests and official language of countries.

Dependent variable is the national IQ test data of Lynn and Vanhanen (2002)

Independent variables are dummy values for official language ('others' have been given a value of zero).

	N	Coefficient (SE)	T-value
Intercept		91.02 (1.25)	73.1 ***
French	27	-12.17 (2.16)	-5.63 ***
Spanish	16	-4.2 (2.76)	-1.52 ns
Arabic	23	-6.19 (2.38)	-2.6 **
English	39	-10.5 (2.0)	-5.28 ***

R^2 (adjusted) = 26%

F = 13.89*** (df = 4, 147)

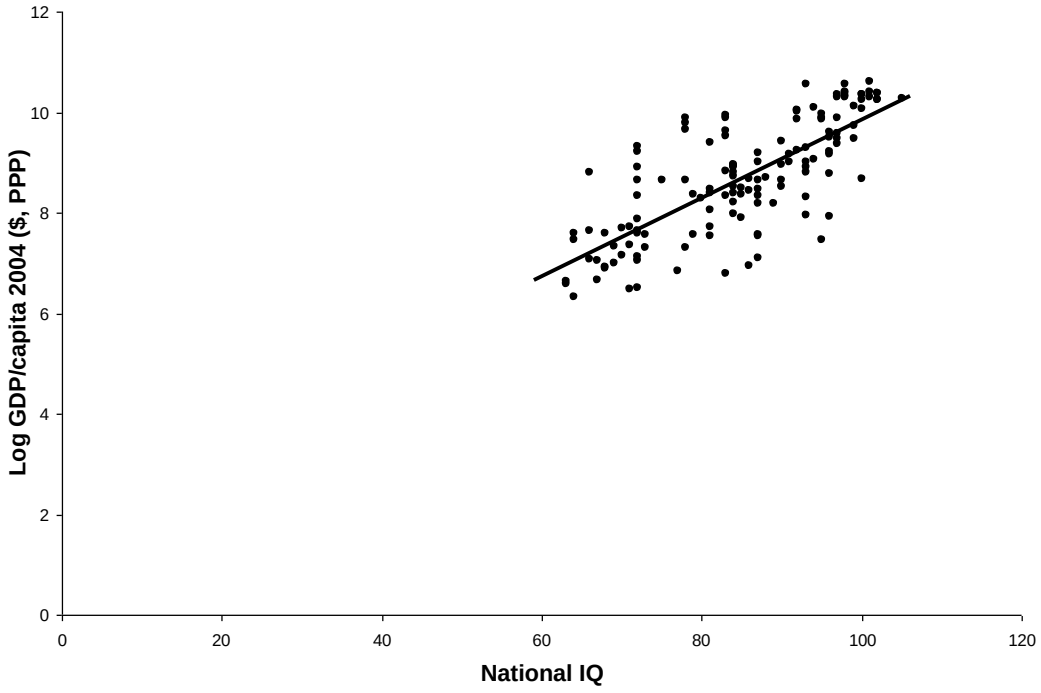
Table 3. Observed LN GDP/capita and LN number of published articles/million population for a sample of richer countries.

Also shown are the predicted LN number of articles/million population based on GDP/capita and the residuals.

Country	LN GDP/capita (2004)	LN Number of articles/million (2004)	Predicted LN Number of articles/million (2004)	Residual
Switzerland	10.41	7.61	6.45	1.16
Sweden	10.29	7.42	6.27	1.15
Finland	10.31	7.30	6.29	1.00
Denmark	10.37	7.30	6.39	0.91
Singapore	10.24	7.09	6.19	0.90
Iceland	10.41	7.27	6.45	0.82
UK	**10.34**	**7.11**	**6.34**	**0.77**
Netherlands	10.37	7.13	6.39	0.75
Australia	10.32	7.05	6.31	0.74
Canada	10.35	7.03	6.36	0.67
Belgium	10.34	7.00	6.35	0.64
Germany	10.25	6.69	6.20	0.48
Austria	10.38	6.88	6.41	0.47
France	10.29	6.67	6.26	0.41
Norway	10.56	7.09	6.69	0.40
Spain	10.13	6.39	6.01	0.38
Italy	10.25	6.43	6.20	0.23
Japan	10.28	6.33	6.26	0.07
Ireland	10.57	6.67	6.70	-0.03
Luxembourg	10.60	5.82	6.75	-0.93

Figure 1. Economic performance as a function of national IQ

Based on the Lynn and Vanhanen dataset, but employing logarithm (base e) of GDP/capita as the dependent variable. GDP/capita taken from the Human Development report for 2006.

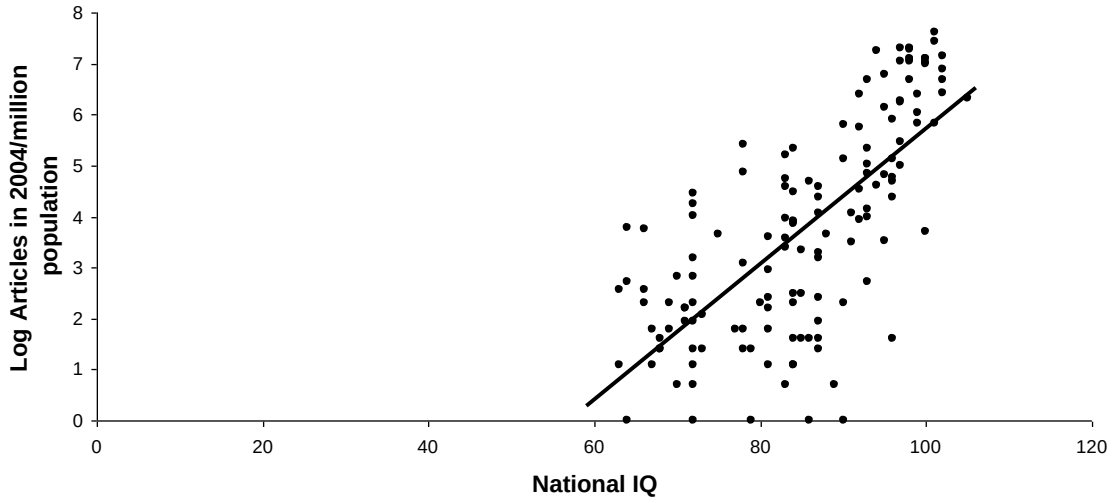


	Coefficient (SE)	T-value
Intercept	2.03 (0.4896)	4.14 ***
National IQ	0.078 (0.0057)	13.74 ***

R^2 (adjusted) = 57.6%
F = 188.75 *** df = 1, 137

Figure 2. Number of journal articles published by authors within a country (per million people) as a function of national IQ

National IQ taken from the Lynn and Vanhanen dataset.
Number of articles per million population taken from Web of Science.

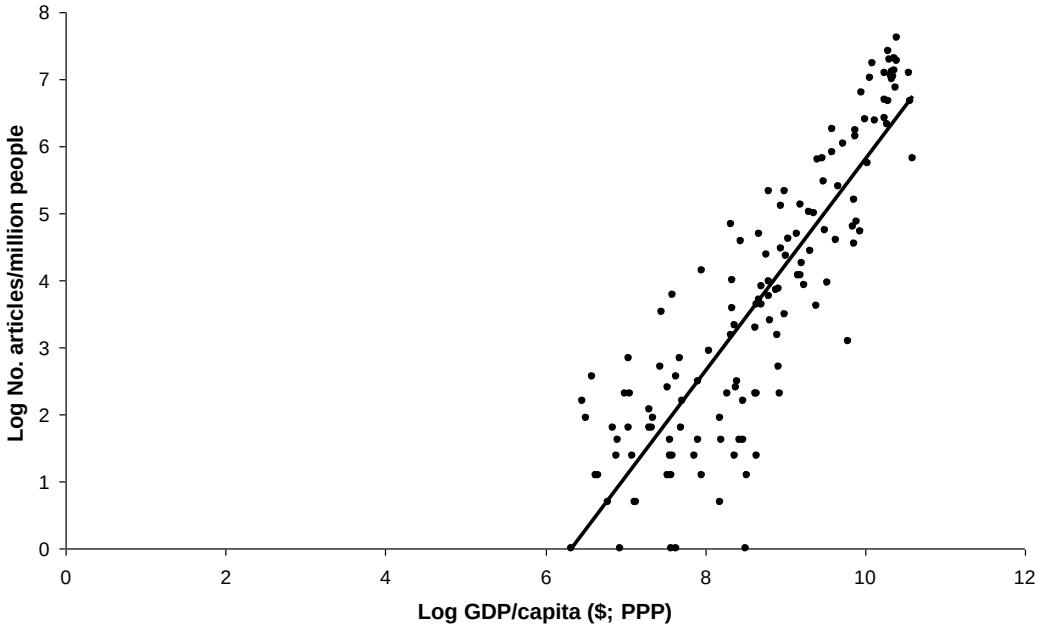


	Coefficient	T-value
Intercept	-7.56 (0.97)	-7.82 ***
National IQ	0.1328 (0.011)	11.8 ***

R^2 (adjusted) = 50.0%
F = 139.3 *** df = 1, 137

Figure 3. Number of journal articles published by authors within a country (per million people) as a function of GDP/capita

Number of articles per million population taken from Web of Science.
GDP/capita (2004) taken from the Human Development report for 2006.



	Coefficient	T-value
Intercept	-10 (0.672)	-14.88 ***
IQ	1.581 (0.077)	20.63 ***

R^2 (adjusted) = 76%
F = 425.56 *** df = 1, 137