ON A DUBIOUS THEORY OF CROSS-COUNTRY DIFFERENCES IN INTELLIGENCE

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Abstract. Kanazawa (2007) offers an explanation for the variation across countries of average intelligence. It is based on the idea that human intelligence is a domain specific adaptation and that both temperature and the distance from some putative point of origin are proxies for the degree of novelty that humans in a country have experienced. However, the argument ignores many other considerations and is *a priori* weak and the data used questionable. A particular problem is that in calculating distances between countries it implicitly assumes that the earth is flat. This makes all the estimates biased and unreliable.

Keywords: intelligence, measurement error, international comparisons

KANAZAWA (2007) posits a theory that human intelligence is a domain specific adaptation and that both temperature and the distance from some putative point of origin are proxies for the degree of novelty that humans in a country have experienced. Applying multiple regression to the cross country data on IQ of LYNN & VANHANEN (2002, 2006) using temperature, and the distance from a country's capital city to two alternative points (one in the Atlantic Ocean) as regressors it is argued that the data corroborates his theory. There are several very questionable features of this model and one serious error which make this results in this paper, in my view, of limited interest. It is regrettable that Kanazawa makes no serious attempt to consider weaknesses in his argument or alternative explanations for his results.

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To describe the data on IQ as controversial is an understatement. Given that the author's use of the data has already been heavily criticised (e.g. ELLISON 2007, DICKINS et al. 2007) a balanced assessment of the data rather than a partisan defence is more appropriate. The lack of descriptive statistics makes it impossible for the reader to form a judgement.[1] The mean for 19 sub-Saharan countries is 67 implying that on average these populations are intellectually challenged. This seems, at best, questionable. If evolutionary forces are the primary determinants of intelligence then one would expect the levels for African Americans to be similar but they are significantly different. According to NEISSER et al. (1996) the intelligence scores for that population are only about 15 points below average *and the gap is falling*. The point is not that the data is bad (that's clearly a big debate) but that it is controversial (that is a fact) and one has an obligation to be candid about it. In his justly famous lecture "Cargo Cult Science" Richard Feynman said "Details that could throw doubt on your interpretation must be given if you know them. You must do the best you can – if you know anything at all wrong or possibly wrong – to explain it. ... [t]he idea is to give all the information to help others to judge the value of your contribution".[2]

Data aside, a number of obvious concerned with the model seem germane. Using the distance between origin and destination ignores any consideration of topography. Clearly the novelty of getting from A to B (and whether one goes directly) will depend greatly on whether mountains, oceans, deserts, etc. lie in the way and the transport technology available. *Homo sapiens* is widely believed to have originated in Sub-Saharan Africa although estimates of when this occurred seem to vary widely between 0.1 to 0.5 million years ago.[3] They arrived at their present locations at varying times and by varying routes. There has also been change in climate patterns over that period. It is unclear why should *recent* (the last 100 years) temperatures alone reflect the *history* of environmental novelty experienced by any group en route to their current location?

A further complication arises because the population in many countries reflects a mixture of racial influences. North America was settled by peoples that arrived via what is now the Bering Straits. Subsequently it was settled by migrants from around Europe and slaves brought from Africa. More recently there has been a significant influx from South and Central America. Why should the distance from some point off the coast of Africa to some city, in, say, the USA reflect the cumulative experience of the current American population? Drawing inferences about individuals in a population from grouped data is subject to many hazards. One that

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[1] There are many critiques of the LYNN and VANHANEN data and the uses to which it is put. For example: BARNETT & WILLIAMS (2004), NECHBYA (2004), BORSBOOM (2006).

[2] R.P FEYNMAN (1997), also available on numerous websites.

[3] There are, it should be noted, alternatives to the "out-of-Africa" theory notably the *multiregional evolution hypothesis* associated with WOLPOFF, for example WOLPOFF (1997), (2004). In such theory there is scope for local evolutionary events to have an effect and this would not be reflected in the model being discussed here.

seems plausible in this context is confounding error: that some omitted factor is generating the correlation seen in the data. Say, for arguments sake, one really does find that more intelligent populations are further from the point of origin in the Rift Valley or elsewhere. Could it be that this is due to some other causal relationship? One possibility is that intelligence is correlated with some other characteristic, for example risk taking or industriousness, which lead to a population travelling further. To survive in a particular location may require a particular set of abilities but this does not mean that getting there causes one to acquire those abilities just as becoming an Oxford or Harvard professor may require one to *be* smart, it does not *make* one smart. One can never rule out all other possible explanations but one needs to search diligently nonetheless. That's what makes a good theory.

The most glaring problem with this paper is that the measure of distance used by Kanazawa, applying Pythagoras' theorem to the differences in longitude and latitude between two points, is simply incorrect. The Pythagoras theorem gives the distance between two points on a flat surface i.e. in two dimensional Euclidean space. The earth is not flat. The distance between any two points on a sphere "as the crow flies" is the length of the corresponding segment of the Great Circle joining the points.[4] Calculating the correct distance between two points is trivially easy since there are several web sites which will calculate it quickly. There may be slight differences in the results (of the order of a few kilometres) because of different approximations used. I list two at the end and used one to illustrate the seriousness of Kanazawa's error. As a reference point, I use the first point considered by Kanazawa, the intersection of the prime meridian and the equator i.e. 0 degrees North and 0 degrees West (henceforth 0N, 0W). This is purely for convenience.[5] *Table 1* gives the distance in kilometres between this point and a set of locations using Kanazawa's formula as well as the correct distance and the proportionate error expressed as a percentage.

As one moves due north towards the pole or west along the equator the error is very small. However, otherwise it is large and does not behave as one might expect. For example the penultimate line shows that the point (45N, 175W) is 14,995km from 0N, 0W and not the 20,057km that Kanazawa's formula would suggest, an error of almost 34%. Now consider a point due north of that (75N,175W). Naïvely, one might expect it to be even further from 0N, 0W and this is what the Euclidean distance would imply. In fact it is significantly *closer* and the error has grown to 81%. This illustrates the serious folly that arises from thinking in planar geometry terms. To understand this, it may be helpful to consider the path one takes in flying

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[4] See ZEIDLER (2004) section 3.2 for example. The earth is not exactly spherical since it bulges slightly at the equator but one can ignore this for practical purposes.

[5] This point lies about 400 miles off the west coast of Africa, some distance from the Rift Valley (around 35 degrees East), and hence is unlikely to be where mankind originated, a point acknowledged by Kanazawa. This error will be particularly severe for the "low intelligence" countries in sub-Saharan Africa which may well be driving these results.

from, say, London to Los Angeles which is 17 degrees further south. Along the great circle, the route takes one initially north over Greenland before heading south. It is critical to understand that it is not simply the presence of measurement error that is the problem but the form. Here the error varies not just with distance but with direction, specifically the extent to which one is travelling due north, south, east or west. How a scientific journal allowed such an error to be published is difficult to understand.

Table 1. Distance from 0N, 0W to selected points in kilometres

(1)	(2)	(3)	(4)	(5)
Latitude: Degrees North	Longitude: Degrees West	Kanazawa's distance	Great circle distance	% Error 100*((4)-(3))/(4)
45	0	4.995	4.985	−0.20
90	0	9.990	10.002	0.12
0	75	8.325	8.349	0.29
45	75	9.709	8.834	−9.90
75	75	11.773	9.574	−22.97
0	125	13.875	13.915	0.29
45	125	14.747	12.677	−16.33
75	125	16.181	10.956	−47.69
0	175	19.425	19.481	0.29
45	175	20.057	14.995	−33.76
75	175	21.134	11.670	−81.09

Note: $(3) = \sqrt{[longitude * 111]^2 + [latitude * 111]^2}$. (4) is calculated from http://gc.kls2.com/. For a reference point other than 0N,0W one replaces longitude with the difference in longitude, etc.

Great Circle distances.
http://gc.kls2.com/ [accessed October 1st 2007].
http://www.wolframalpha.com

The consequences of measurement error in an explanatory variable in multiple regression can be severe. If the measurement error arises in one variable only and is "Classical" (i.e. completely random) the coefficient on that variable is biased towards zero and all the other coefficients are biased (so called "contamination bias") but the direction of the bias is unknown *a priori*. The distance variable is mismeasured and to an extent that varies across country.

These problems will not be helped by measurement error in the dependent variable. In this case the IQ data is based on a wide variety of methods, different sampling frames and with widely differing numbers of within-country estimates.

Hence the reliability of the IQ estimates varies and, more specifically, is inversely related to the average level: more advanced (& colder) countries tend to have more reliable data and also higher averages. This means that measurement error in the dependent variable is unlikely to be random, a particularly severe problem in multiple regression. So the error has a systematic component since the error will be correlated with the true distance and with some of the other covariates. What all of this means is that the estimated coefficients will be biased but one cannot know *a priori* in what direction.[6]

A further consequence is that in the presence of one mis-measured variable, proxies for that variable may (spuriously) appear to be statistically significant in predicting some outcome.[7] This may explain why longitude and latitude feature in the results since there is no compelling other reason for them to be there, *conditional on distance*. The fact that coefficients are statistically significant is no consolation: a precisely estimated but arbitrarily biased coefficient is distinctly unhelpful. Hence, I would argue, these regression results should be taken with a very large grain of salt.

So, whatever the merits of the underlying hypothesis, the empirical implementation of the model is, in my opinion, significantly below the level one expects of scholarly research. Essentially the paper seems to be putting a veneer of sophistication on the fact that in many poorer sub-Saharan countries measured IQ appear to be strikingly lower than average. Why one should prefer a distal over a proximal explanation for this correlation is unclear when the former is necessarily speculative and there is plenty of evidence that the current environment (e.g. culture, schooling, nutrition) exercises a significant influence on intelligence.[8] There may well be long run effects such as those essayed by Kanazawa but they should not be considered to the exclusion of other factors where one has much better data. That human psychology is subject to evolutionary pressures is hardly contentious and understanding those pressures is an important and intellectually fascinating scientific challenge. This process of understanding will not be helped by careless research.

How one might go about testing such a model is not immediately obvious. However, one could start by focusing on countries where the data is more reliable and where the implicit assumptions are more plausible. For example one could focus on more homogenous populations that could have assumed to have arrived by the same route and at the same time. It would also be important to "stress-test" the model by checking for the effect of outliers and influential observations. In some cases there may be natural experiments which provide sharp contrasts such as a given population which separated into two or more groups and migrated or if one

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[6] See GREENE (2007) or most texts on multiple regression or econometrics. In the presence of classical measurement error, Instrumental Variables can be used to find consistent estimates of the regression parameters.

[7] See BOUND, BROWN and MATHIOWETZ (2001).

[8] See NEISSER et al. (1996), pp. 86–90.

could locations with multiple groups that arrived by different routes. A great deal of careful work, tracing how particular groups go to where they are, is needed rather than the broad-brush (not to say inept) statistical work discussed here.

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