IQ is largely a pseudoscientific swindle

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For some technical backbone to this piece,see here.

*(**Revised draft**: added comments on sinister country profiling. Also 1) Used the same data as researchers to find that **R^2 for IQ-wealth and IQ-income is effectively 0** in spite of the circularity. 2) Turns out IQ beats random selection in the **best** of applications by less than 6%, typically <2%, as the computation of correlations have a flaw and psychologists do not seem to know the informational value of correlation in terms of "how much do I gain information about B knowing A" and propagation of error (intra-test variance for a single individual). 3) Added information showing the story behind the effectiveness of Average National IQ is, statistically, a fraud. The psychologists who engaged me on this piece — with verbose writeups —made the mistake of showing me the best they got: papers with the strongest pro-IQ arguments. **They do not seem to grasp what noise/signal really means in practice**.)*

Background : "IQ" is a stale test meant to measure mental capacity but in fact mostly measures **extreme unintelligence** (learning difficulties), as well as, to a lesser extent (with a lot of noise), a form of intelligence, stripped of 2nd order effects — how good someone is at taking some type of exams designed by unsophisticated nerds. It is *via negativa* not *via positiva*. Designed for learning disabilities, and given that it is not too needed there (see argument further down), it ends up selecting for exam-takers, paper shufflers, obedient IYIs (intellectuals yet idiots), ill adapted for "real life". (The fact that it correlates with general incompetence makes the overall correlation look high, even when it is random, see Figures 1 and 2.) The concept is poorly thought out mathematically by the field (commits a severe flaw in correlation under fat tails and **asymmetries**; fails to

properly deal with **dimensionality**; treats the mind as an instrument not a complex system), and seems to be promoted by

- Racists/eugenists, people bent on showing that *some* populations have inferior mental abilities based on *IQ test=intelligence;* those have been upset with me for suddenly robbing them of a "scientific" tool, as evidenced by the bitter reactions to the initial post on twitter/smear campaigns by such mountebanks as Charles Murray. (**Something observed by the great Karl Popper, psychologists have a tendency to pathologize people who bust them by tagging them with some type of disorder, or personality flaw such as "childish" , "narcissist", "egomaniac", or something similar)**. Note the online magazine *Quillette* seems to be a cover for a sinister eugenics program (with tendencies I've called "neo-Nazi" under the cover of "free thought".) Note I am finding statistical flaws in Richard Plomin's work — the pope of twin studies (see intransitivity of correlation in my technical addendum; he doesn't get it).

- Psychometrics peddlers looking for suckers (military, large corporations) buying the "this is the best measure in psychology" argument when it is not even technically a measure — it explains at best between 2 and 13% of the performance in *some* tasks (**those tasks that are similar to the test itself**)[see interpretation of .5 correlation further down], minus the data massaging and statistical cherrypicking by psychologists; it doesn't satisfy the monotonicity and transitivity required to have a measure (at best it is a concave measure). No measure that fails 80–95% of the time should be part of "science" (nor should psychology — owing to its sinister track record — be part of science (rather **scientism**), but that's another discussion).

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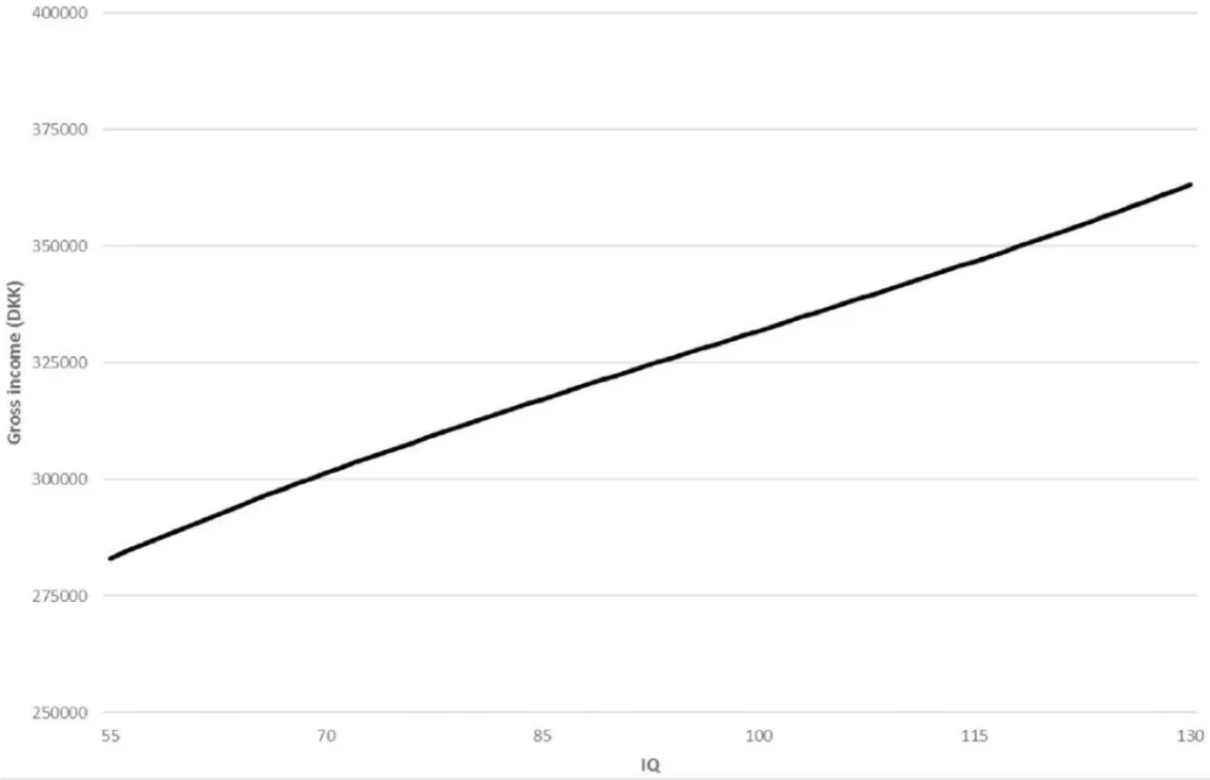
Low IQ as a predictor of unsuccessful educational and occupational achievement: A register-based study of 1,098,742 men in Denmark 1968–2016



Typical confusion: Graphs in Intelligence showing an effect of IQ and income for a large cohort. Even ignoring circularity (test takers get clerical and other boring jobs), injecting noise would show the lack of information in the graph. Note that the effect shown is lower than the variance between tests **for the same individual!**

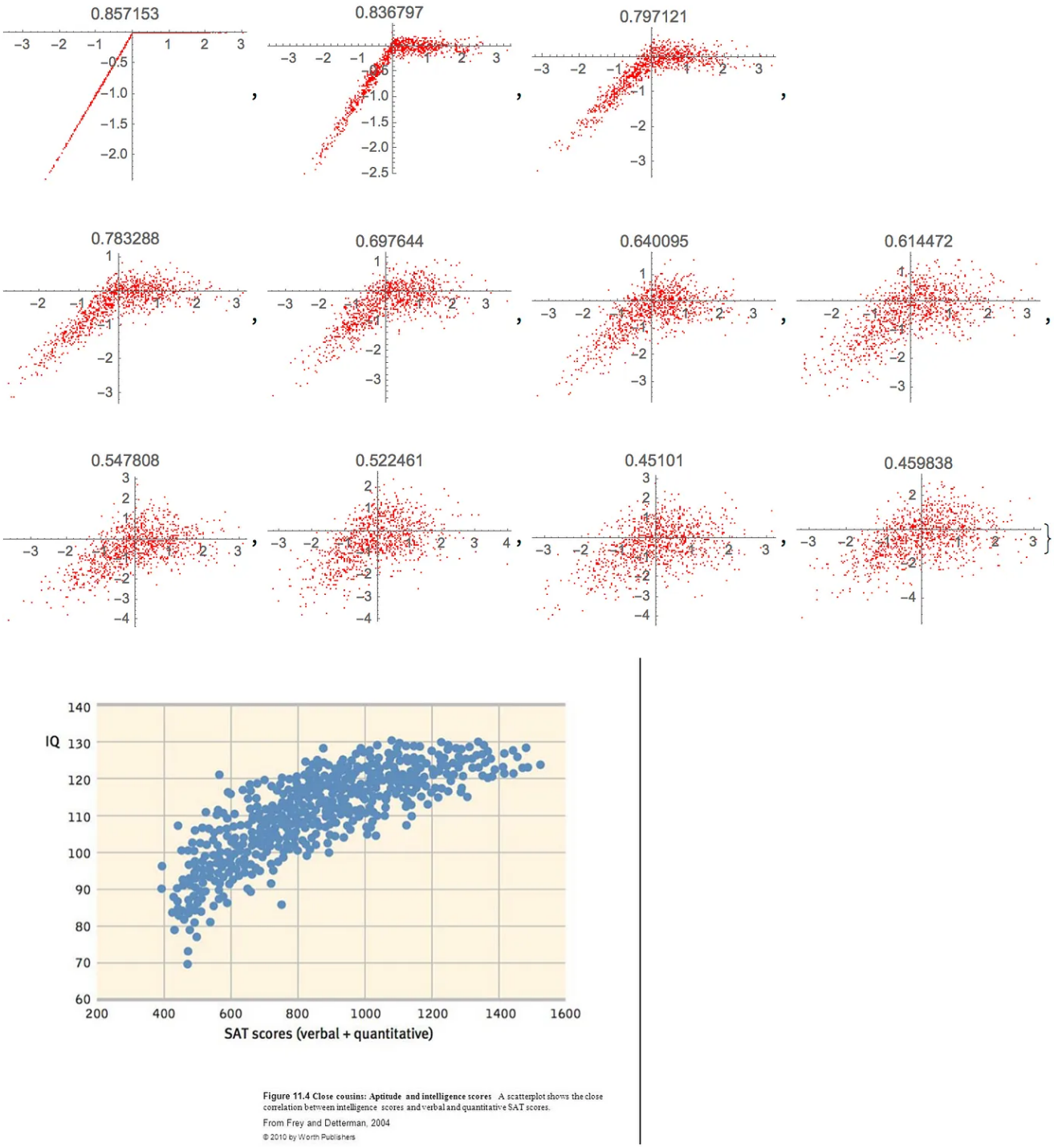


Fig 1: The graph that summarizes the first flaw (assuming thin tailed situations), showing that "correlation" is meaningless in the absence of symmetry. We construct (in red) an intelligence test (horizontal), that is 100% correlated with negative performance (when IQ is, say, below 100) and 0% with upside, positive performance. We progressively add noise (with a 0 mean) and see correlation (on top) drop but shift to both sides. Performance is on the vertical axis. The problem gets worse with the "g" intelligence based on principal components. By comparison we show (graph below) the distribution of **IQ and SAT scores**. Most "correlations" entailing IQ suffer the same pathology. Note: this is in spite of the fact that IQ tests overlap with the SAT! (To echo Haldane, one ounce of rigorous algebra is worth more than a century of verbalistic statisticopsycholophastering).

- It is at the bottom an **immoral** measure that, while not working, can put people (and, worse, groups) in boxes for the rest of their lives.

- **There is no significant statistical association between IQ and hard measures such as wealth.** Most "achievements" linked to IQ are measured in circular stuff s.a. bureaucratic or academic success, things for test takers and salary earners in structured jobs that resemble the tests. Wealth may not mean success but it is the only "hard" number, not some discrete score of achievements. You can buy food with a $30, not with other "successes" s.a. rank, social prominence, or having had a selfie with the Queen.

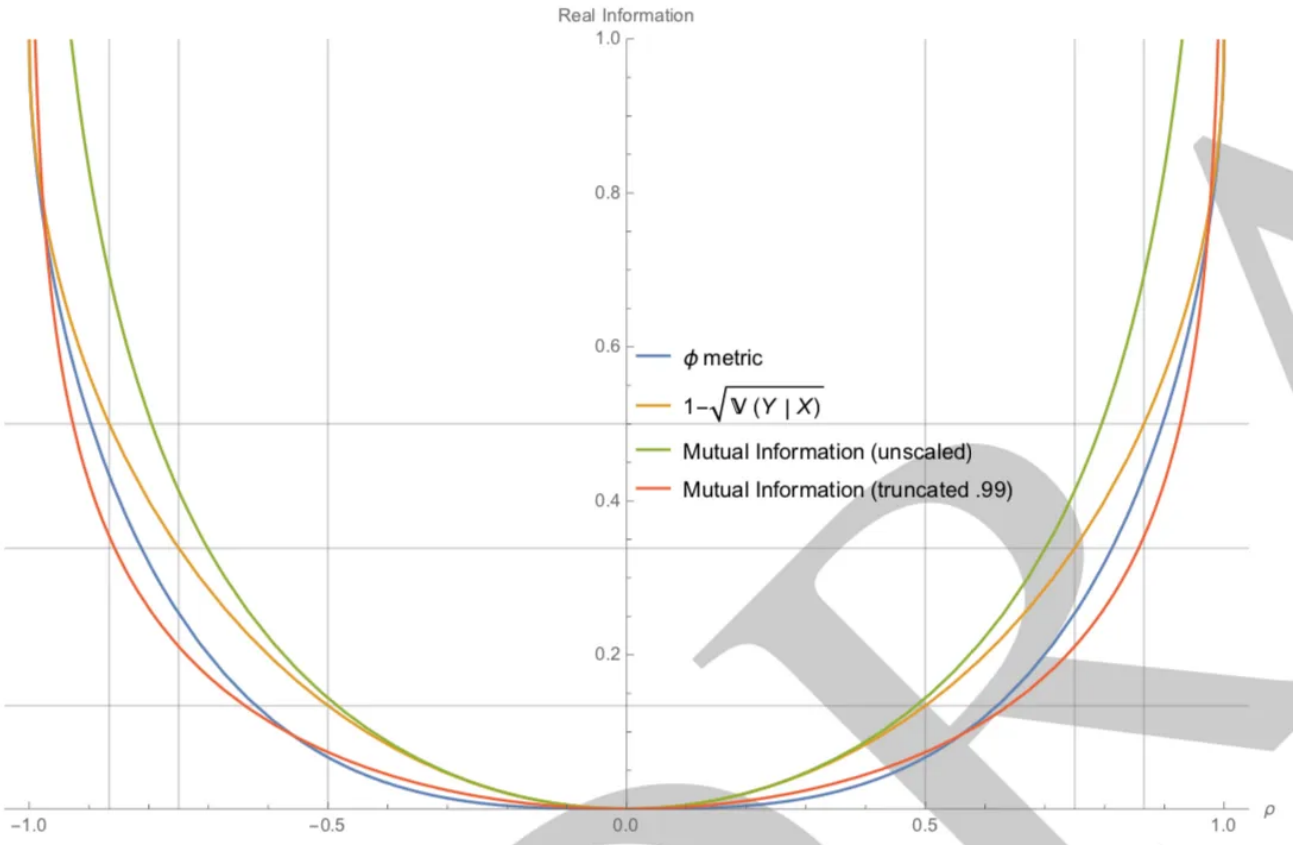


Fig. 6. Various rescaling methods,linerarizing information and putting correlation in perspective.

The informational interpretation of correlation, in terms of "how much information do I get about A knowing B". Add to that the variance in results of IQ tests for the very same person.

QUIZ
You administer IQ tests to 10K people, then give them a "performance test" for anything, any task.
2000 of them are dead. Dead people score 0 on IQ and 0 on performance. The rest have the IQ uncorrelated to the performance
What is the spurious correlation IQ/performance?

Solution : 37.5 %

The systematic bias comes from the fact that if you hit someone on the head with a hammer, he will be bad at **everything**. (And any test of incompetence can work there). There is no equivalent to someone suddenly becoming good at everything.
Hence **all tests of competence** will some some positive correlatation to IQ even if they are random! And if you see a low correlation, means that the real correlation is... negative.

Analytic Solution

Assume $X, Y \approx$ Uniform Distribution[0, 1] as most representative.

p alive, $(1-p)$ dead (or in the clinial tails)

We have $\rho = \dfrac{\mathbb{E}\left((X-\mathbb{E}(X))(Y-\mathbb{E}(Y)\right)}{\sqrt{\mathbb{E}\left((X-\mathbb{E}(X))^2\,\mathbb{E}\left((Y-\mathbb{E}(Y)\right)^2}}$

$\mathbb{E}(X) = p\int_0^1 x\,dx + (1-p)\int_0^1 0\,dx$, same for $\mathbb{E}(Y)$.

Allora :

$$\rho = \frac{p\int_0^1\left(\int_0^1 (x-\mathrm{Ex})(y-\mathrm{Ey})\,dx\right)dy + (1-p)\int_0^1\left(\int_0^1 (0-\mathrm{Ex})(0-\mathrm{Ey})\,dx\right)dy}{\left(p\int_0^1 (x-\mathrm{Ex})^2\,dx + (1-p)\int_0^1 (0-\mathrm{Ex})^2\,dx\right)} = 1 + \frac{1}{-4+3p}$$

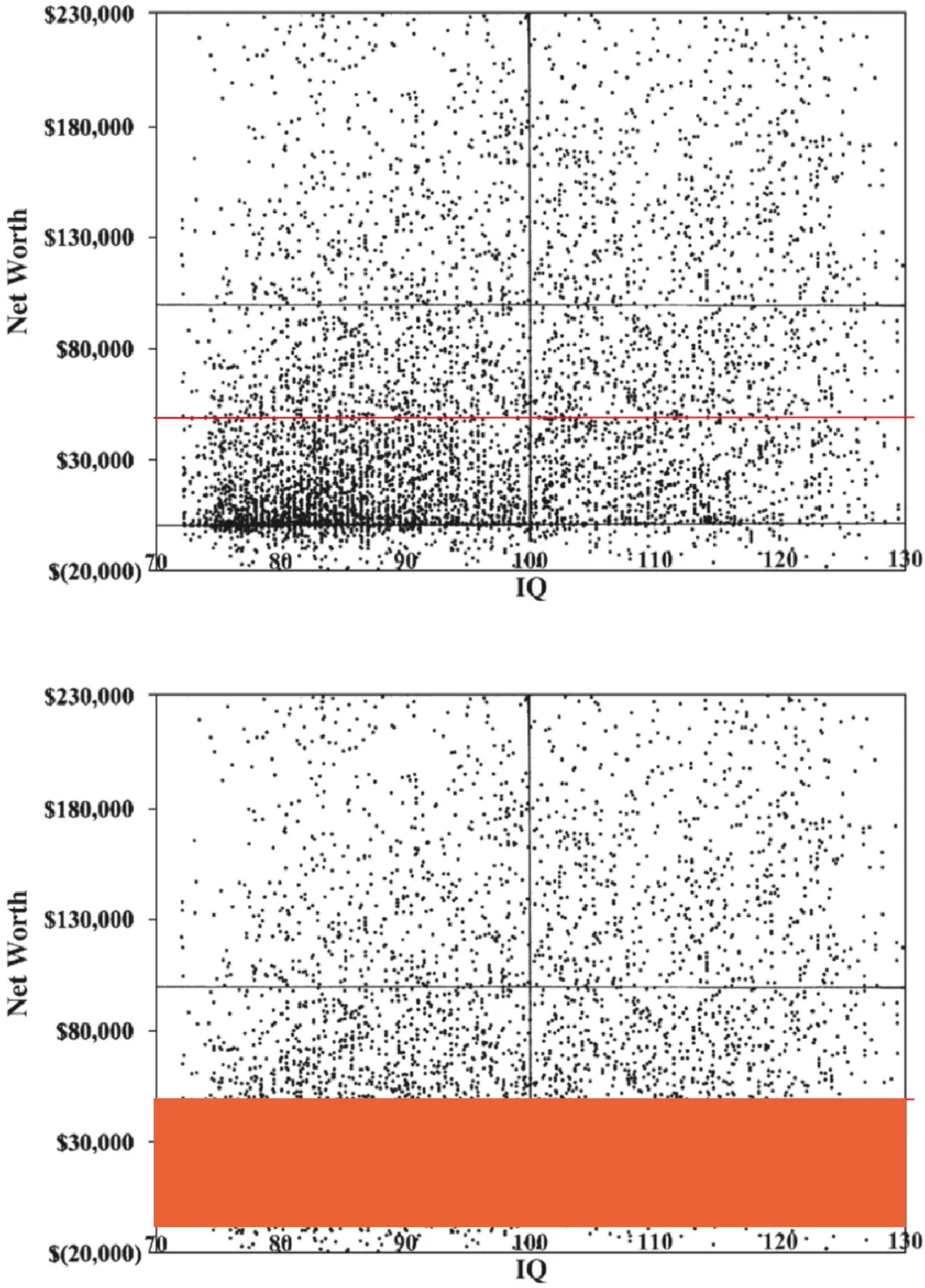
Which shows how all psycholophasters do is benefit from the asymmetry that low end is **necessarily** correlated. For there is no "reverse dead" equivalent.

An extension of the first flaw that shows how correlations are overestimated. Probability is hard.

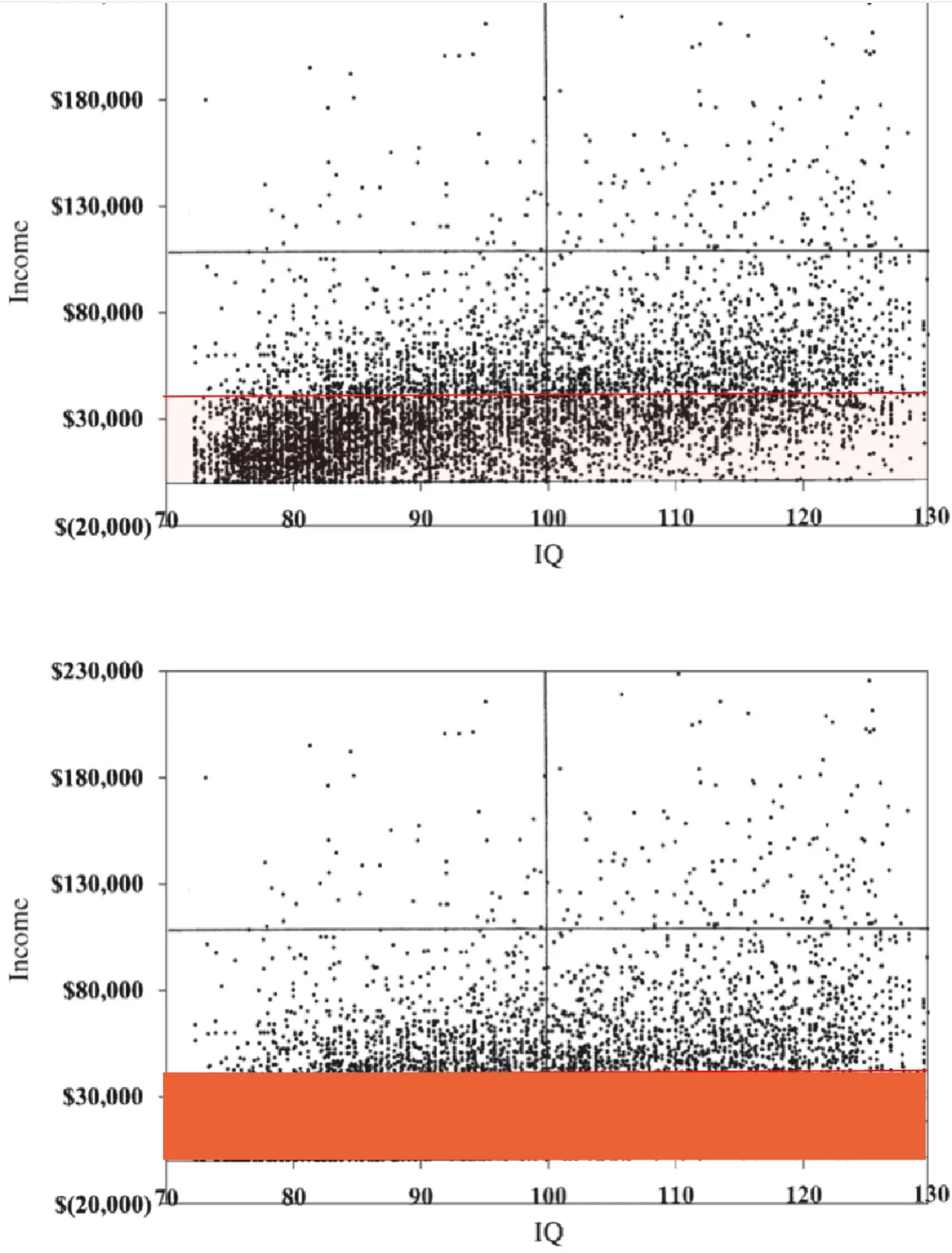
- Psychologists do not realize that the effect of IQ (if any, ignoring circularity) is smaller than the difference between IQ tests for the same individual (correlation is 80% between test and retest, meaning you being you explains less than 64% of your test results and, worse, you are t**wo thirds of a standard deviation away from yourself.**).

- Some argue that IQ measures intellectual capacity — real world results come from, in addition, "wisdom" or patience, or "conscientiousness", or decision-making or something of the sort. No. **It does not even *measure* intellectual capacity/mental powers.**

If you want to detect how someone fares at a task, say loan sharking, tennis playing, or random matrix theory, make him/her do that task; we don't need theoretical exams for a real world function by probability-challenged psychologists. Traders get it right away: hypothetical P/L from "simulated" paper strategies doesn't count. Performance=actual. What goes in people's head as a reaction to an image on a screen doesn't exist (except via negativa).



IQ and wealth at low scale (outside the tail). Mostly Noise and no strikingly visible effect above $40K, but huge noise. Psychologists responding to this piece do not realize that statistics is about not interpreting



There is little information IQ/Income. From Zagorsky (2007). I redid the data and found suspicious selection from NLS database that truncates both Income, wealth and IQ in tails which artificially boosts R^2. [Will follow up with my own study since R^2 appears to be <.01 for Income and ,.02 for wealth, in spite of curcularity of test taking!]

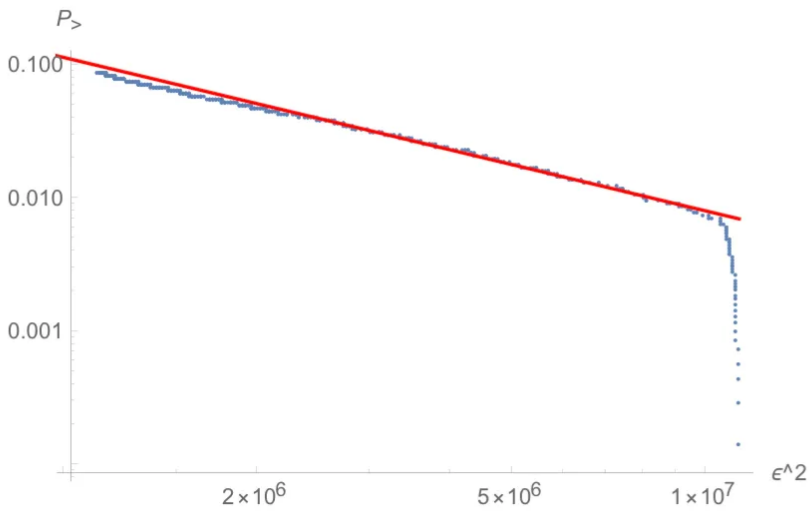


Figure 5.10: *The loglogplot of the squared residuals ϵ^2 for the IQ-income linear regression using standard Winsconsin Longitudinal Studies (WLS) data. We notice that the income variables are winsorized. Clipping the tails creates the illusion of a high R^2. Actually, even without clipping the tail, the coefficient of determination will show much higher values owing to the small sample properties for the variance of a power law.*

R² is effectively zero!

Fat Tails If IQ is Gaussian *by construction* (well, almost) and if real world performance were, net, fat tailed (it is), then either the covariance between IQ and performance doesn't exist or it is uninformational. It will show a finite number *in sample* but doesn't exist statistically — and the metrics will overestimare the predictability. Another problem: when they say "black people are *x* standard deviations away", they don't know what they are talking about. Different populations have different variances, even different skewness and these comparisons require richer models. These are severe, severe mathematical flaws (a billion papers in psychometrics wouldn't count if you have such a flaw). See the formal treatment in my next book.

Mensa members: typically high "IQ" losers in Birkenstocks.

But the “intelligence” in IQ is determined by academic psychologists (no geniuses) like the “paper trading” we mentioned above, via statistical constructs s.a. *correlation* that I show here (see Fig. 1) that *they patently don’t understand*. It does correlate to very negative performance (as it was initially designed to detect learning special needs) but then any measure would work there. A measure that works in the left tail not the right tail (IQ decorrelates as it goes higher) is problematic. We have gotten similar results since the famous Terman longitudinal study, even with massaged data for later studies. To get the point, consider that if someone has mental needs, there will be 100% correlation between performance and IQ tests. But the performance doesn’t correlate as well at higher levels, though, unaware of the effect of the nonlinearity, the psychologists will think it does.(The statistical spin, as a marketing argument, is that a person with an IQ of 70 cannot prove theorems, which is obvious for a measure of **unintelligence** — but they fail to reveal how many IQs of 150 are doing menial jobs. So “vey low IQ” may provide information, while “very high IQ” may convey nothing better than random — it is not even a necessary condition.).

It is a false comparison to claim that IQ “measures the hardware” rather than the software. It can measure **some** arbitrarily selected mental abilities (in a testing environment) believed to be useful. However, if you take a Popperian-Hayekian view on intelligence, you would realize that to measure future needs it you would need to know the *mental* skills needed in a future ecology, which requires predictability of said future ecology. It also requires some ergocity, the skills to make it to the future (hence the need for mental “biases” for survival). **Example**: you are designing a car for “performance”. A Maserati will perform best on a track and beat a goat there. But what if you need to cross the Corsican garigue? A goat will be ideal then. In NYC during traffic, pedestrians beat cars. So the notion of “performance” needs to be associated with a specific environment and necessarily predictive of it. (Footnote: Herb’s Simon’s notion of scissors:one blade represents capabilities, the other bladethe situational context.) The “g” because of its mathematical flaws fails to produce a general solution to this.

Definition 2.1 (The Best Map Fallacy).
Unconditionally preferring a false map to no map at all. More technically, ignoring the fact that decision-making entails alterations in $f(x)$ in the absence of knowledge about x.

About every reasonable person facing an plane ride with an unreliable risk model or a high degree of uncertainty about the safety of the aircraft would take a train instead; but the same person, in the absence of skin in the game, when working as a professor, professional manager or "risk expert" would say : "well, I am using the best model we have" and use something not reliable, rather than be consistent with real-life decisions and subscribe to the straightforward principle : "let's only take those risks for which we have a reliable model".

The best map is a violation of the central principle of risk management, Principle 2.2.

The fallacy is explained in *The Black Swan* [**?**]:

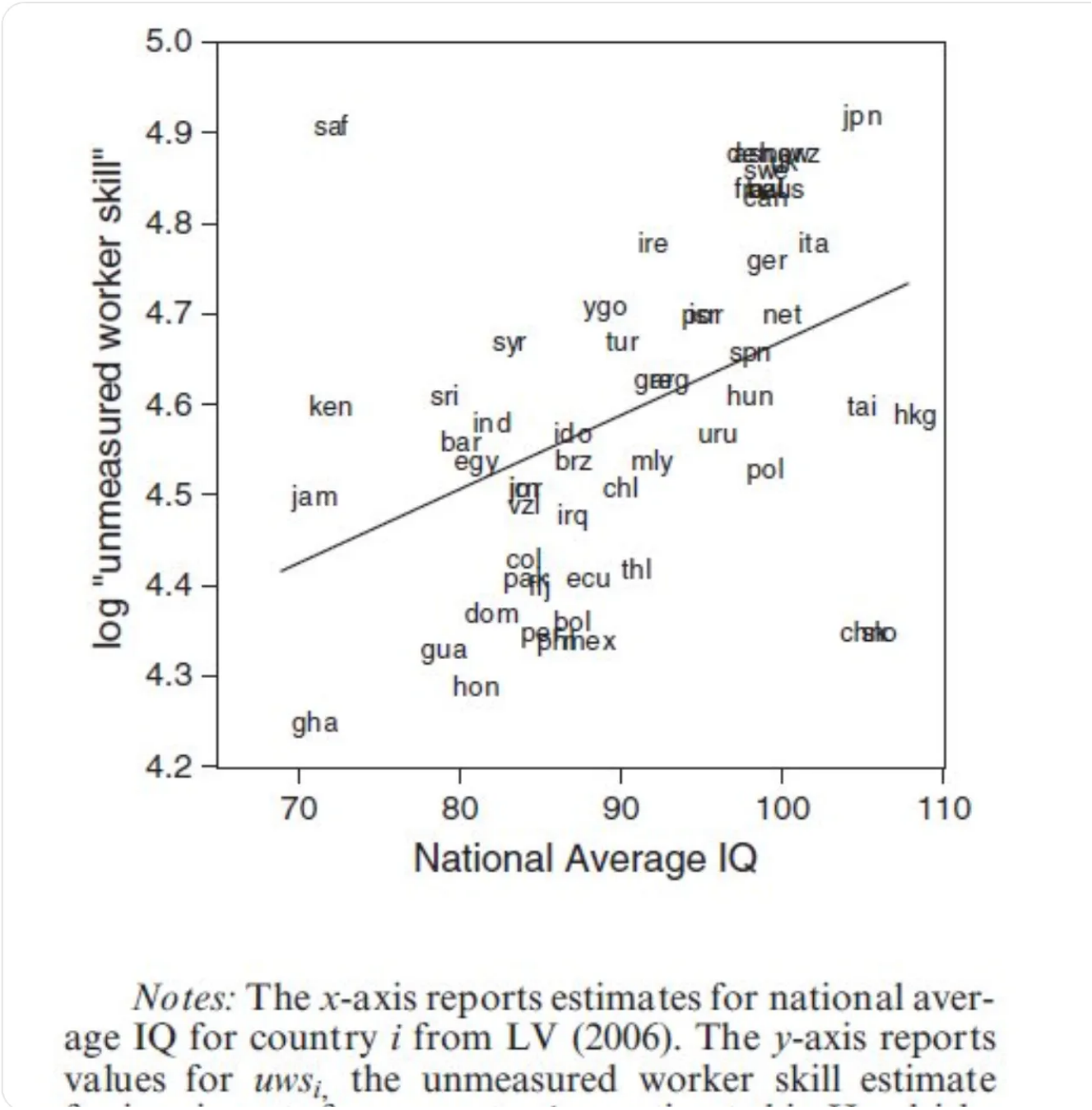
> I know few people who would board a plane heading for La Guardia airport in New York City with a pilot who was using a map of Atlanta's airport "because there is nothing else." People with a functioning brain would rather drive, take the train, or stay home. Yet once they get involved in economics, they prefer professionally to use a wrong measure, on the ground that "we have nothing else." The idea, well accepted by grandmothers, that one should pick a destination for which one has a good map, not travel and then find "the best" map, is foreign to PhDs in social science.

This is not a joke: the "give us something better" has been a recurring problem this author has had to deal with for a long time.

The Best Map Fallacy (Technical Incerto)

Real Life: In academia there is no difference between academia and the real world; in the real world there is. 1) When someone asks you a question in the real world, you focus first on "**why** is he/she asking me that?", which shifts you to the environment (see Fat Tony vs Dr John in *The Black Swan*) and detracts you from the problem at hand. Philosophers have known about that problem forever. **Only suckers don't have that instinct.** Further, take the sequence {1,2,3,4,*x*}. What should *x* be? Only someone who is clueless about induction would answer 5 as if it were the *only* answer (see Goodman's problem in a philosophy textbook or ask your closest Fat Tony) [**Note:** We can also apply here Wittgenstein's rule-following problem, which states that any of an infinite number of functions is compatible with any finite sequence. Source: Paul Bogossian]. Not only clueless, but obedient enough to want to think in a certain way. 2) Real life never never offers crisp questions with crisp answers (most questions don't have answers; perhaps the worst problem with IQ is that it seem to selects for people who don't like to say "there is no answer, don't waste time, find something else".) 3) It takes a certain type of person to waste intelligent concentration on classroom/academic problems. These are lifeless bureaucrats who can muster **sterile motivation.** Some people can only focus on

problems that are real, not fictional textbook ones (see the note below where I explain that I can only concentrate with real not fictional problems). 4) IQ doesn't detect **convexity** of mistakes (by an argument similar to bias-variance you need to make a lot of small inconsequential mistake in order to avoid a large consequential one. See *Antifragile* and how *a*ny measure of "intelligence" w/o convexity is sterile edge.org/conversation/n...). To do well you must survive; survival requires some mental biases directing to some errors. 5) ***Fooled by Randomness***: seeing shallow patterns in not a virtue — it leads to naive interventionism. Some psychologist wrote back to me: "IQ selects for pattern recognition, essential for functioning in modern society". No. Not seeing patterns except when they are significant is a virtue in real life. 6) To do well in life you need depth and ability to select your own problems and to think independently. And one has to be a lunatic (or a psychologist) to believe that a standardized test will reveal **independent** thinking.



Notes: The *x*-axis reports estimates for national average IQ for country *i* from LV (2006). The *y*-axis reports values for uws_i, the unmeasured worker skill estimate

This is no longer a regression. It is scientific fraud. A few random points from the same distribution can invert the slope of the regression. (From Jones and Schneider, 2010 attempting to make sense of the race-motivated notion of Average National IQ).

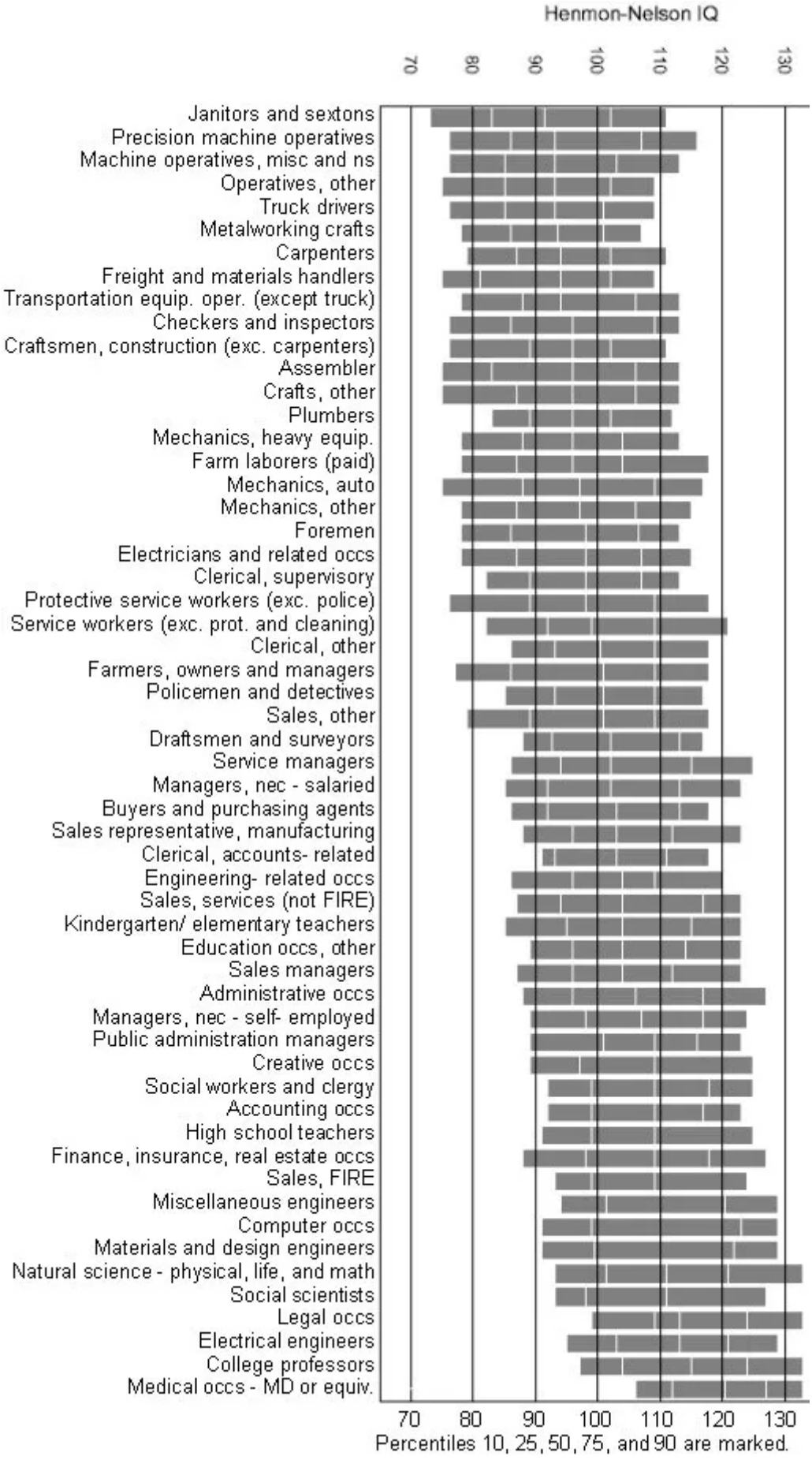
such a variety of jobs.

▲ Figure 3.1 Correlation of IQ with different aspects of job performance. (Figure adapted from Kuncel and Hezlett, 2010, with permission from Sage.)

Upper bound: discount the massaging and correlation effects. Note that 50% correlation corresponds to 13% improvement over random picks. Figure from the highly unrigorous **Intelligence: All That Matters** by S. Ritchie.

National IQ is a Fraud. From engaging participants (who throw buzzwords at you), I realized that the concept has huge variance, enough to be uninformative. See graph. And note that the variance *within* populations is not used to draw conclusions (you average over functions, don't use the funciton over averages) — a problem acute for tail contributions.

[In fact the seminal study says "for 104 of the 185 countries, no studies were available" and they computed the numbers... from ethnicity. Aside from intransivity of correlation, this is pure **fraud**.]



Notice the noise: the top 25% of janitors have higher IQ than the bottom 25% of college professors, even counting the circularity. The circularity bias shows most strikingly with MDs as medical schools require a higher SAT score.

Recall from *Antifragile* that if wealth were fat tailed, you'd need to focus on the tail minority (for which IQ has unpredictable payoff), never the average. *Further it is leading to racist imbeciles who think that if a country has an IQ of 82 (assuming it is true not the result of lack of such training), it means politically that all the people there have an IQ of 82, hence let's ban them from immigrating.* As I said they don't even get elementary statistical notions such as variance. Some people use National IQ as a basis for genetic differences: it doesn't explain the sharp changes in Ireland and Croatia upon European integration, or, in the other direction, the difference between Israeli and U.S. Ashkenazis.

Additional Variance: Let us return to the point of the correlation test-retest. Unlike measurements of height or wealth, which carry a tiny relative error, many people get yuugely different results for the same IQ test (I mean the same person!), up to 2 standard deviations as measured across people, higher than the sampling error in the population itself! This additional source of sampling error weakens the effect by propagation of uncertainty way beyond its predictability when applied to the evaluation of a single individual. It also tells you that you as an individual are vastly more diverse than the crowd, at least with respect to that measure!

There is a severe nonlinearity in the correlation test-retest, in addition to the problem of intransitivity of correlation discussed in the technical note. Imagine a chronometer that varies by 1 hour per measurement!

Biases in Research: If, as psychologists show (see figure) MDs and academics tend to have a higher "IQ" that is slightly informative (higher, but on a noisy average), it is largely because to get into schools you need to score on a test similar to "IQ". The mere presence of such a filter increases the visible mean and lower the visible variance. Probability and statistics confuse fools.

Functionary Quotient: If you renamed IQ , from "Intelligent Quotient" to FQ "Functionary Quotient" or SQ "Salaryperson Quotient", then *some* of the stuff will be true. It measures best the ability to be a good slave confined to linear tasks. "IQ" is good for @davidgraeber's "BS jobs".

Metrification: If someone came up w/a numerical"Well Being Quotient" WBQ or "Sleep Quotient", SQ, trying to mimic temperature or a physical quantity, you'd find it absurd. But put enough academics w/physics envy and race hatred on it and it will become an official measure.

Notes And Technical Notes

- The argument by psychologists to make IQ useful is of the sort: *who would you like to do brain surgery on you/who would you hire in your company/who would you recommend, someone with a 90 IQ or one with 130* is ...academic. Well, you pick people on task-specific performance, which should include some filtering. In the real world you interview people from their CV (not from some IQ number sent to you as in a thought experiment), and, once you have their CV, the 62 IQ fellow is naturally eliminated. **So the only think for which IQ can select, the mentaly disabled, is already weeded out in real life**: he/she can't have a degree in engineering or medicine. Which explains why IQ is unnecessary and using it is risky because you miss out on the Einsteins and Feynmans.

- "IQ" is most predictive of performance in military training, with correlation~.5, (which is circular since hiring isn't random and training is another test).

- Plomin who studies heredity doesn't seem aware of the intransitivity of correlation. Among other flaws (he does not seem to know how to extract heredity, but that's another problem).

- There are contradictory stories about whether IQ ceases to work past a threshold, since Terman's longitudinal study of "geniuses". What these researchers don't get is these contradictions come from the fact that **the variance of the IQ measure increases with IQ**. Not a good thing.

- The argument that "some races are better at running" hence [some inference about the brain] is stale: mental capacity is much more dimensional and not defined in the same way running 100 m dash is.

- I have here no psychological references in this piece (except via negativa, taking their "best"), not that I didn't read these crap papers: simply, the field is bust. So far ~ 50% of the research does not replicate, and papers that do have weaker effect. Not counting the poor transfer to reality (psychological papers are *ludic*). How P values often — rather almost always — fraudulent: my paper arxiv.org/pdf/1603.07532...

- The Flynn effect should warn us not just that IQ is somewhat environment dependent, but that it is at least partly circular.

- **Verbalism:** Psychologists have a skin-deep statistical education & can't translate something as trivial as "correlation" or "explained variance" into meaning, esp.

under nonlinearities (see paper at the end).

- **The "best measure" charlatans:** IQ is reminiscent of risk charlatans insisting on selling "value at risk", VaR, and RiskMetrics saying "it's the best measure". That "best" measure, being unreliable blew them up many many times. Note the class of suckers for whom a bad measure is better than no measure across domains.

- You can't do statistics without probability.

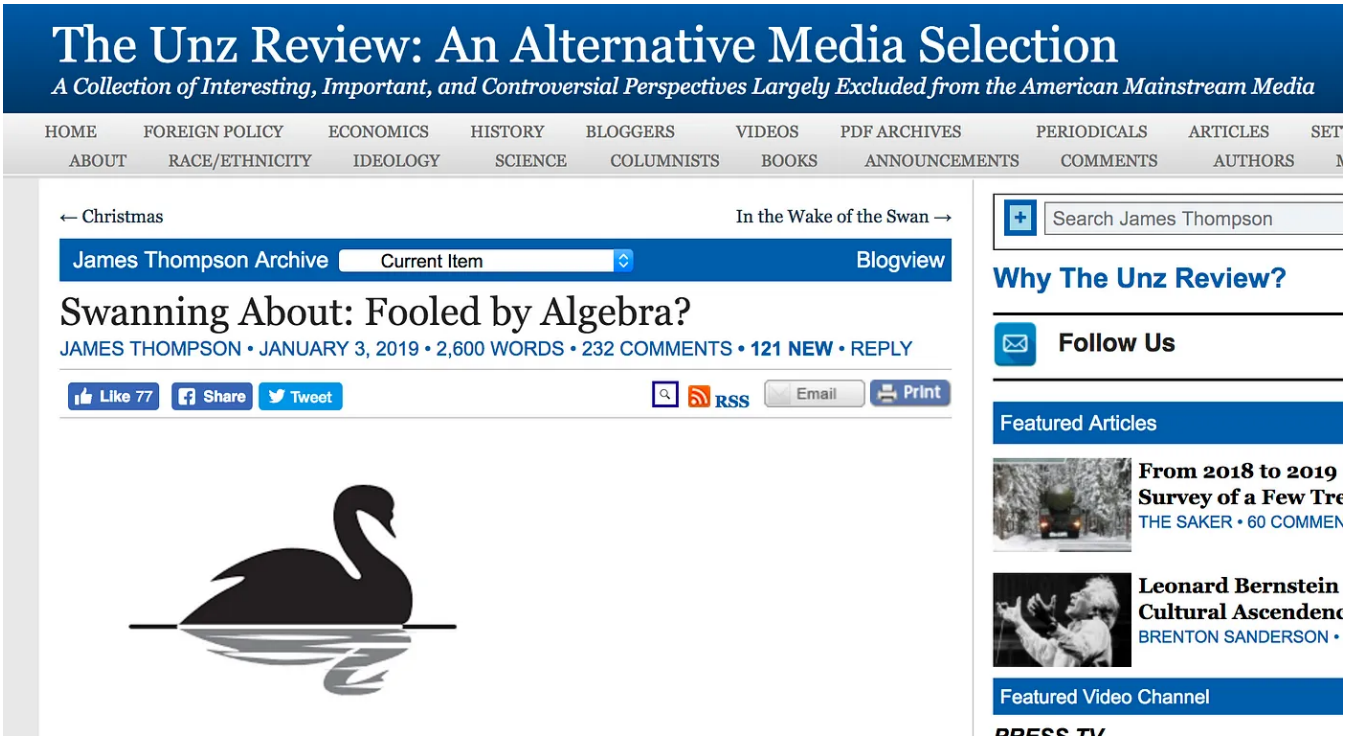
- Much of the stuff about IQ of physicists is suspicious, from self-reporting biases/selection in tests.

- If you looked at Northern Europe from Ancient Babylon/Ancient Med/Egypt, you would have written the inhabitants off as losers who are devoid of potential... Then look at what happened after 1600. Be careful when you discuss populations.

- The same people hold that IQ is heritable, that it determines success, that Asians have higher IQs than Caucasians, degrade Africans, then don't realize that China for about a Century had one order of magnitude lower GDP than the West.

Responses by Psychologists

- Alt-Right groups such as James Thompson



Reactions to this piece in the Alt-Right Media: all they got is a psychologist who still hasn't gotten to the basics of elementary correlation and noise/signal. The fact that psychologists selected him to defend them (via retweets) speaks volumes about their sophistication.

- Hack job by one Jonatan Pallesen, full of mistakes about this piece (and the "empiricism"), promoted by mountebanks such as Murray. He didn't get that of course one can produce "correlation" from data. It is the interpretation of these correlations that is full of BS. Pallesen also produces some lies about what I said which have been detected in online comments (e.g. the quiz I gave and using Log vs X).

Mathematical Considerations

Nonlinear Correlation

THEOREM

Let $f(x) = (-R_1 + x)\,\mathbb{1}_{x<R_1}$, $R_1 \le 0$, $x \in \mathbb{R}$

We have prove that: if for any piecewise linear function $f(.)$ such that $\rho_{-R,R_1} = 1$, $\rho_{R,R_1} = 0$, where $\rho_{.,.}$ denote piecewise correlation in $[-R, R_1)$ and $(R_1, R]$,

the unconditional correlation ρ

$$\rho = \frac{2R - R_1}{R\sqrt{-3 + \frac{8R}{R+R_1}}}$$

where $\rho_{-R,R} = \dfrac{\int_{-R}^{R}\left(x - \frac{1}{2R}\int_{-R}^{R} x\,dx\right)\left(f(x) - \frac{1}{2R}\int_{-R}^{R} f(x)\,dx\right)dx}{\sqrt{\int_{-R}^{R}\left(x - \frac{1}{2R}\int_{-R}^{R} x\,dx\right)^2 dx\left(\int_{-R}^{R}\left(f(x) - \frac{1}{2R}\int_{-R}^{R} f(x)\,dx\right)^2 dx\right)}}$

In the **special symmetric case** where $R_1 = 0$,

$$\rho = \frac{2}{\sqrt{5}} \approx .894$$

In the **probabilistic case ,**

using the weighting operator $\lambda(.)\,(-R, R) \to [0, 1]$:

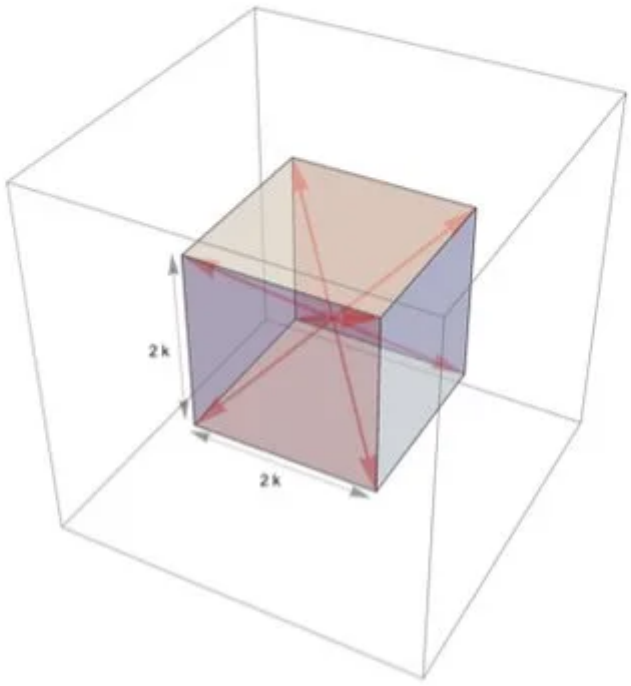
$$\rho = \frac{\int_{-R}^{R}\left(x - \int_{-R}^{R} x\,\lambda(x)\,dx\right)\left(f(x) - \int_{-R}^{R} f(x)\,\lambda(x)\,dx\right)\lambda(x)\,dx}{\sqrt{\int_{-R}^{R}\left(x - \int_{-R}^{R} x\,\lambda(x)\,dx\right)^2 \lambda(x)\,dx\left(\int_{-R}^{R}\left(f(x) - \int_{-R}^{R} f(x)\,\lambda(x)\,dx\right)^2 \lambda(x)\,dx\right)}}$$

Relation to the curse of dimensionality (Belman [9], Hastie et al.[10]): our growth is slower than that of the curse of dimensionality as we are concerned with the mean error around a point, not the sampling of a hypercube.

The geometric intuition is as follows. Take a d-hypercube $[0,1]^d$. With $d=1$, take an interval $k \in (0, \frac{1}{2})$ in the center $[\frac{1}{2}-k, \frac{1}{2}+k]$, the mean distance between the center and the points represents k proportion of the line. Add a dimension: with $d=2$, one gets a square with sides k; the mean (Euclidean) distance from the center $(\frac{1}{2}, \frac{1}{2})$ to the points $(\frac{1}{2} \pm k, \frac{1}{2} \pm k)$ is $\sqrt{2}k$. Generalizing, the mean distance becomes $\sqrt{d}k$ of the space (Euclidean) and the mean (absolute) norm is $d\,k$.

Now let's call $2k$ the "error" band around the center. As d increases the metric between sides of the error band (no matter how defined) converges to 1.

With the curse of dimensionality, to span $2k$ ratio of the hypercube requires $(2k)^{\frac{1}{d}}$ as in the figure below.



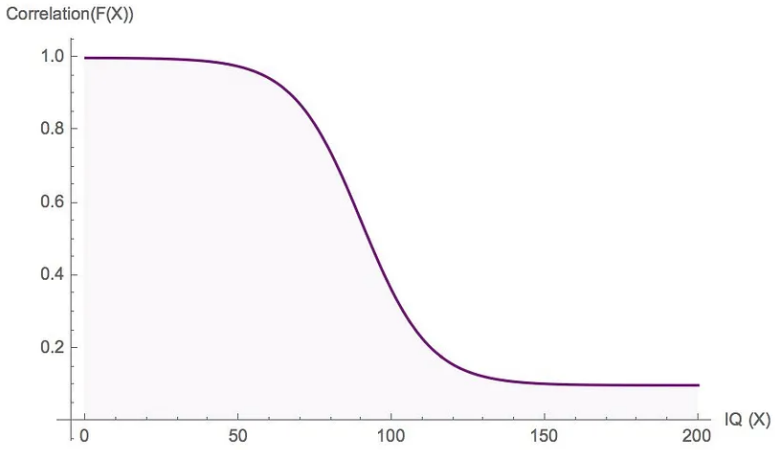
But as with the curse of dimensionality, all the "variations" in the hypercube will eventually be attributable to the "error".

Further when we go beyond probability and translate the error in terms of a function of higher dimensional random vector, errors become just as explosive as with

Flaws in the IQ reports as the "g" PCA is highly misspecified.

A simplified proof, using 2 dimensional case, and generalizing.

Consider correlation between X and Y as state dependent as in figure below.



Traditionally one writes the cov matrix

$$\Sigma = \begin{pmatrix} \sigma_{11}^2 & \sigma_{11}\,\sigma_{22}\,\rho \\ \sigma_{11}\,\sigma_{22}\,\rho & \sigma_{22}^2 \end{pmatrix}$$ Here we can't anymore since ρ is X dependent

$$\Sigma(x) = \begin{pmatrix} \sigma_{11}^2 & \sigma_{11}\,\sigma_{22}\,f(x) \\ \sigma_{11}\,\sigma_{22}\,f(x) & \sigma_{22}^2 \end{pmatrix};$$

Now the eigenvalues of the matrix Σ are also X dependent.

$$\lambda(x) = \begin{pmatrix} \frac{1}{2}\left(-\sqrt{4\,\sigma_{22}^2\,\sigma_{11}^2\,f(x)^2+\sigma_{11}^4-2\,\sigma_{22}^2\,\sigma_{11}^2+\sigma_{22}^4}+\sigma_{11}^2+\sigma_{22}^2\right) \\ \frac{1}{2}\left(\sqrt{4\,\sigma_{22}^2\,\sigma_{11}^2\,f(x)^2+\sigma_{11}^4-2\,\sigma_{22}^2\,\sigma_{11}^2+\sigma_{22}^4}+\sigma_{11}^2+\sigma_{22}^2\right) \end{pmatrix}.$$

We have the second derivative no longer flat–– as we see in the graph the function is not just non constant but nonlinear; nonlinearities show in second derivative,

$$\lambda'(x) = \begin{pmatrix} \frac{1}{2}\left(-\frac{4\,\sigma_{11}^2\,\sigma_{22}^2\,f(x)\,f''(x)}{\sqrt{4\,\sigma_{22}^2\,\sigma_{11}^2\,f(x)^2+\sigma_{11}^4-2\,\sigma_{22}^2\,\sigma_{11}^2+\sigma_{22}^4}}+\frac{16\,\sigma_{11}^4\,\sigma_{22}^4\,f(x)^2\,f'(x)^2}{\left(4\,\sigma_{22}^2\,\sigma_{11}^2\,f(x)^2+\sigma_{11}^4-2\,\sigma_{22}^2\,\sigma_{11}^2+\sigma_{22}^4\right)^{3/2}}-\frac{4\,\sigma_{11}^2\,\sigma_{22}^2\,f'(x)^2}{\sqrt{4\,\sigma_{22}^2\,\sigma_{11}^2\,f(x)^2+\sigma_{11}^4-2\,\sigma_{22}^2\,\sigma_{11}^2+\sigma_{22}^4}}\right) \\ \frac{1}{2}\left(\frac{4\,\sigma_{11}^2\,\sigma_{22}^2\,f(x)\,f''(x)}{\sqrt{4\,\sigma_{22}^2\,\sigma_{11}^2\,f(x)^2+\sigma_{11}^4-2\,\sigma_{22}^2\,\sigma_{11}^2+\sigma_{22}^4}}-\frac{16\,\sigma_{11}^4\,\sigma_{22}^4\,f(x)^2\,f'(x)^2}{\left(4\,\sigma_{22}^2\,\sigma_{11}^2\,f(x)^2+\sigma_{11}^4-2\,\sigma_{22}^2\,\sigma_{11}^2+\sigma_{22}^4\right)^{3/2}}+\frac{4\,\sigma_{11}^2\,\sigma_{22}^2\,f'(x)^2}{\sqrt{4\,\sigma_{22}^2\,\sigma_{11}^2\,f(x)^2+\sigma_{11}^4-2\,\sigma_{22}^2\,\sigma_{11}^2+\sigma_{22}^4}}\right) \end{pmatrix}$$

implying yuuuge random terms affecting loads and the "factors".Application : Use one convex – concave funtion as above

$f(x) = \frac{1}{20}\left(2+9\,\text{Erfc}\left[\frac{-90+x}{\sqrt{2}\,\sigma}\right]\right)$; example above matches $\sigma \to 16$.

The above is NOT a representation of IQ/Correlation but the mathematical consequences of correlation not being constant.

CURSE OF DIMENSIONALITY A flaw in the attempts to identify "intelligence" genes. You can get monogenic traits, not polygenic (note: additive monogenic used in animal breeding is NOT polygenic).

The Skin in the game issue

I Am Dumb Without Skin in the Game

Let us return to *pathemata mathemata* (learning through pain) and consider its reverse: learning through thrills and pleasure. People have two brains, one when there is skin in the game, one when there is none. Skin in the game can make boring things less boring. When you have skin in the game, dull things like checking the safety of the aircraft because you may be forced to be a passenger in it cease to be boring. If you are an investor in a company, doing ultra-boring things like reading the footnotes of a financial statement (where the real information is to be found) becomes, well, almost not boring.

But there is an even more vital dimension. Many addicts who normally have a dull intellect and the mental nimbleness of a cauliflower—or a foreign policy expert—are capable of the most ingenious tricks to procure their drugs. When they undergo rehab, they are often told that should they spend half the mental energy trying to make money as they did procuring drugs, they are guaranteed to become millionaires. But, to no avail. Without the addiction, their miraculous powers go away. It was like a magical potion that gave remarkable powers to those seeking it, but not those drinking it.

A confession. When I don't have skin in the game, I am usually dumb. My knowledge of technical matters, such as risk and probability, did not initially come from books. It did not come from lofty philosophizing and scientific hunger. It did not even come from curiosity. It came from the thrills and hormonal flush one gets while taking risks in the markets. I never thought mathematics was something interesting to me until, when I was at Wharton, a friend told me about the financial options I described earlier (and their generalization, complex derivatives). I immediately decided to make a career in them. It was a combination of financial trading and complicated probability. The field was new and uncharted. I knew in my guts there were mistakes in the theo-

Note From Skin in the Game, 1

ries that used the conventional bell curve and ignored the impact of the tails (extreme events). I knew in my guts that academics had not the slightest clue about the risks. So, to find errors in the estimation of these probabilistic securities, I had to study probability, which mysteriously and instantly became fun, even gripping.

When there was risk on the line, suddenly a second brain in me manifested itself, and the probabilities of intricate sequences became suddenly effortless to analyze and map. When there is fire, you will run faster than in any competition. When you ski downhill some movements become effortless. Then I became dumb again when there was no real action. Furthermore, as traders the mathematics we used fit our problem like a glove, unlike academics with a theory looking for some application—in some cases we had to invent models out of thin air and could not afford the wrong equations. Applying math to practical problems was another business altogether; it meant a deep understanding of the problem before writing the equations.

But if you muster the strength to weight-lift a car to save a child, above your current abilities, the strength gained will stay after things calm down. So, unlike the drug addict who loses his resourcefulness, what you learn from the intensity and the focus you had when under the influence of risk stays with you. You may lose the sharpness, but nobody can take away what you've learned. This is the principal reason I am now fighting the conventional educational system, made by dweebs for dweebs. Many kids would learn to love mathematics if they had some investment in it, and, more crucially, they would build an instinct to spot its misapplications.

Note from Skin in the Game, 2

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Discussion

The problem is beyond psychology: The real world is more random than regression analyses

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Soyer and Hogarth (this issue) identify unexpected and severe errors of interpretation of the parameters in linear regression on the part of people on whose expertise we rely upon, namely those who are involved in econometric and statistical analyses in their professional work. Their results show two major issues: first, a divorce between the analytical definitions and their practical interpretation; second, the one-way effect of underestimation of the random character of the process generating the data (or, equivalently, the overestimation of the deterministic effect of the parameters). We (see Goldstein & Taleb, 2007) have identified both of these problems in the interpretation of the commonly used notion of standard deviation, used in finance as a proxy for "volatility", and have found similar errors on the part of persons of similar expertise. First, we observed that despite the fact that our participants could define the standard deviation mathematically, they erred in its practical application, as if there was a severe loss in the translation of an abstract mathematical term into its practical meaning. Second, as in the case of Soyer and Hogarth's study, we observed an underestimation of the role and effect of randomness. Our participants underestimated the standard deviation, while those in Soyer and Hogarth's study underestimated the practical effects of it. However, the most severe problem may lie elsewhere: the tools themselves underestimate randomness.

In the Soyer and Hogarth case, the matter at hand is standard regression and Gaussian probabilities, and participants are asked to make probabilistic interpretations using the Gaussian as the normative framework for the computation of frequencies, as is a general assumption in economics. Econometrics is dominated by standard deviations, and more generally by measures in the L2 norm,[1] based on squares of numbers (SD is the square root of the average of the sum of the squared deviations), all of which are grounded in a class that revolves around the Gaussian family: the Gaussian and related distributions that converge to it under a reasonable amount of summation, such as the binomial, Poisson, chi-square, and exponential distributions. The problem is that the Gaussian distribution is of limited applicability outside of textbook examples — it is the type of randomness that prevails in game setups such as coin tosses, or possibly in quantum mechanics. Using it leads to the underestimation of fat tails and the role of extreme events, and to predictions that underestimate their own errors. For instance, Taleb (2009) showed, using close to 20 million pieces of economic data (most economic variables over a period spanning the past forty years) that:

(i) the data have fat tails, meaning that the errors would be dominated by larger deviations than estimated;
(ii) the "fat tailed" nature of the data does not disappear under aggregation, meaning that the sum of the variables remains fat-tailed, which eliminates the hypothesis of convergence to Gaussian thin-tailedness; and
(iii) the fat-tailedness of the data is impossible to estimate, though we know that the process is fat-tailed.

Assume that we have agreed that kurtosis is a measure of the degree of fat-tailedness of the process (a scaled fourth moment of the distribution). For all variables, the kurtosis depends on a very small number of observations — for instance, nearly 78% of the total kurtosis of the US stock market for 10,000 observations of data depends on one single observation, implying that we are unable to figure out the fat-tailedness of the process within the L2 norm

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[1] A norm $Lp = \left(\frac{1}{n}\sum |x|^p\right)^{1/p}$.

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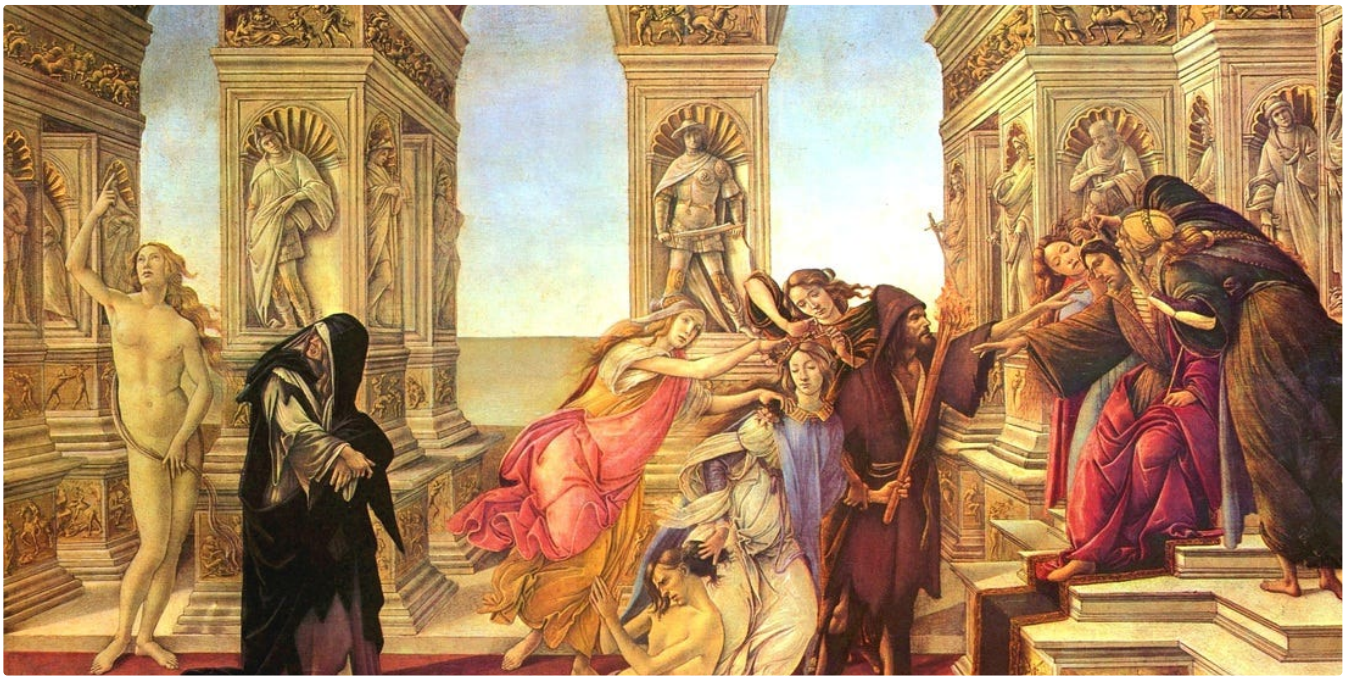

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