

Some interesting pieces

Here are some interesting pieces I've read recently (up to 28 February 2014). I've categorised them roughly according to the schema in my essay: '*Some thoughts on education and political priorities*' (version 2.0 [here](#), October 2013).

This is my favourite, a 1955 essay (reprinted by Forbes) - *Can we survive technology?* - by one of the handful of the best brains of the 20th Century, John von Neumann. He was one of the most important mathematicians who, in his spare time from pure maths, also created a mathematical framework for the (then) new quantum mechanics, invented modern game theory, (with Turing) invented the architecture for the modern computer, played an important role in the Manhattan Project, and pioneered ideas about machine intelligence, the brain, and artificial life (cellular automata) that are still inspiring people. Many aspects of interdisciplinary complex system research trace back to work by von Neumann. An Endnote of my essay (p. 147-182) discusses some of this.

He describes the impact of science and technology on political institutions and human decision-makers. Now, the UK political system almost entirely shuts out people like von Neumann from influence (interestingly unlike post-1945 Washington which used vN very extensively). A new approach to government would find ways of letting such rare people help.

'For progress there is no cure.'

'In all its stages the industrial revolution consisted of making available more and cheaper energy, more and easier controls of human actions and reactions, and more and faster communications. Each development increased the effectiveness of the other two. All three factors increased the speed of performing large-scale operations--industrial, mercantile, political, and migratory. But throughout the development, increased speed did not so much shorten time requirements of processes as extend the areas of the earth affected by them. The reason is clear. Since most *time* scales are fixed by human reaction times, habits, and other physiological and psychological factors, the effect of the increased speed of technological processes was to enlarge the size of units - political, organizational, economic, and cultural - affected by technological operations. That is, instead of performing the same operations as before in less time, now larger-scale operations were performed in the same time. This important evolution has a natural limit, that of the earth's actual size. The limit is now being reached, or at least closely approached.'

[But could we escape some of these constraints by a combination of, *inter alia*, solar power and expansion into space with all its practically unlimited resources of energy and valuable materials, in the first instance *via* some sort of reusable hypersonic space plane that can drastically reduce the cost per Kg of getting to orbit? America, Russia, China, and Britain all have projects to do this... Cf. Section 2 of my essay and below. After all, vN himself said during the war that science would soon make it possible to travel beyond the moon...]

'Such developments as free energy, greater automation, improved communications, partial or total climate control have common traits deserving special mention. First, though all are intrinsically useful, they can lend themselves to destruction... Technology - like science - is neutral all through, providing only means of control applicable to any purpose, indifferent to all... Second, there is in most of these developments a trend toward ... producing effects that can be projected from any one to any other point on the earth. There is an intrinsic conflict with geography - and institutions based thereon - as understood today... The technology that is now developing and that will dominate the next decades seems to be in total conflict with traditional and, in the main, momentarily still valid, geographical and political units and concepts...

'Whatever one feels inclined to do, one decisive trait must be considered: the very techniques that create the dangers and the instabilities are in themselves useful, or closely related to the useful. In fact, the more useful they could be, the more unstabilizing their effects can also be. It is not a particular perverse destructiveness of one particular invention that creates danger. Technological power, technological efficiency as such, is an ambivalent achievement. Its danger is intrinsic...

'The crisis will not be resolved by inhibiting this or that apparently particularly obnoxious form of technology... Hence the banning of particular technologies would have to be enforced on a worldwide basis. But the only authority that could do this effectively would have to be of such scope and perfection as to signal the *resolution* of international problems rather than the discovery of a *means* to resolve them.

'A much more satisfactory solution than technological prohibition would be eliminating war as "a means of national policy."... [How?] Apparently only day-to-day - or perhaps year-to-year - opportunistic measures, a long sequence of small, correct decisions. And this is not surprising. After all, the crisis is due to the rapidity of progress, to the probable further acceleration thereof, and to the reaching of certain critical relationships. Specifically, the effects that we are now beginning to produce are of the same order of magnitude as that of "the great globe itself." Indeed, they affect the earth as an entity. Hence further acceleration can no longer be absorbed as in the past by an extension of the area of operations. Under present conditions it is unreasonable to expect a novel cure-all. For progress there is no cure. Any attempt to find automatically safe channels for the present explosive variety of progress must lead to frustration. The only safety possible is relative, and it lies in an intelligent exercise of day-to-day judgment.

'Present awful possibilities of nuclear warfare may give way to others even more awful. After global climate control becomes possible, perhaps all our present involvements will seem simple. We should not deceive ourselves: once such possibilities become actual, they will be exploited. It will, therefore, be necessary to develop suitable new political forms and procedures. All experience shows that even smaller technological changes than those now in the cards profoundly transform political and social relationships. Experience also shows that these transformations are not *a priori* predictable and that most contemporary "first guesses" concerning them are wrong. For all these reasons, one should take neither present difficulties nor presently proposed reforms too seriously.

'The one solid fact is that the difficulties are due to an evolution that, while useful and constructive, is also dangerous. Can we produce the required adjustments with the necessary speed? The most hopeful answer is that the human species has been subjected to similar tests before and seems to have a congenital ability to come through, after varying amounts of trouble. To ask in advance for a complete recipe would be unreasonable. We can specify only the human qualities required: patience, flexibility, intelligence.'

<http://features.blogs.fortune.cnn.com/2013/01/13/can-we-survive-technology/>

I. Maths and complexity.

On Fields Medallist Terry Tao's recent new ideas about the Navier-Stokes equations - one of the six Millennium prizes.

<https://www.simonsfoundation.org/quanta/20140224-a-fluid-new-path-in-grand-math-challenge/>

Fields Medallist Tim Gowers suggests a new idea to solve $P=NP?$, another of the Millennium prizes.

<http://gowers.wordpress.com/2013/10/24/what-i-did-in-my-summer-holidays/>

For those interested in the foundations of maths, discussions about Gödel etc.

<https://www.simonsfoundation.org/quanta/2013/126-to-settle-infinity-question-a-new-law-of-logic/>
<http://www.ias.edu/about/publications/ias-letter/articles/2013-summer/awodey-coquand-univalent-foundations>
<http://infproc.blogspot.co.uk/2013/06/horizons-of-truth.html>

A summary of fifty years of chaos theory.

<http://scitation.aip.org/content/aip/magazine/physicstoday/article/66/5/10.1063/PT.3.1977>

Even in chaotic systems, we are finding ways to make predictions. Unsurprisingly, such work is being pursued particularly for potential use in financial markets.

<http://www.wired.com/wiredscience/2013/10/chaos-theory-dragon-kings/>
<http://arxiv.org/pdf/1301.0244v3.pdf>

How much maths is secret?

<http://www.math.columbia.edu/~woit/wordpress/?p=6243>
<http://www.scottaaronson.com/blog/?p=1517>

2. Energy and space.

There have been various announcements on hypersonic drones. E.g. DARPA's new XS-I experimental spaceplane program 'aims to develop a reusable first stage that enables a cost in the range of \$5 million to get 3,000 pounds to 5,000 pounds to LEO [\$1,000 per pound].' [The British SKYLON project sadly continues to be mishandled.]

<http://www.defense.gov/news/newsarticle.aspx?id=121474>

The amazing opportunity of exoplanet research.

http://www.nytimes.com/2014/02/17/opinion/looking-for-a-mirror.html?_r=1

Some points from an interesting piece on energy sources and renewables, by Vaclav Smil in *Scientific American*, Jan 2014... Each major energy source has taken 50-60 years to rise to top spot: coal reached 5% of global supply in 1840 and ~50% only in 1900, gradually displacing wood; oil reached 5% in 1915 and has never hit 50%; natural gas reached 5% in 1930 and has spread more slowly. Fossil fuels reached 50% in about 1885 in America, 1930 in the Soviet Union, 1965 in China, and the 1970s in India. Modern renewables (solar, wind, geothermal, biofuels) have only reached ~3% in 2012. How to store surplus energy from renewables? Only one good large-scale solution so far: pump water to an elevated reservoir so it can flow down later through a turbine. Not many places can make this work and it involves net energy loss. Broad research is necessary: who would have guessed in 1980 that the best return on federal investment in energy innovation would come not from nuclear or photovoltaic but from work on horizontal drilling and hydraulic fracturing ('fracking') of shale deserts?

3. Physics and computation.

Ten lessons from the Standard Model, by Nobel-winning physicist Frank Wilczek.

<http://www.pbs.org/wgbh/nova/blogs/physics/2014/01/ten-lessons-from-the-standard-model/>

What we know and don't know, by Nobel-winning physicist Steve Weinberg.

<http://www.nybooks.com/articles/archives/2013/nov/07/physics-what-we-do-and-dont-know/?pagination=false>

Excerpt from Ed Frankel's great new book, *Love and Math*.

<http://www.scientificamerican.com/article/the-holy-grail-of-quantum-physics-on-your-kitchen-table-excerpt/>

Options for the LHC's successor.

<http://theconversation.com/a-larger-hadron-collider-why-bigger-is-better-in-particle-physics-23699>

Physicists demonstrate quantum superposition in molecules of >800 atoms.

<https://medium.com/the-physics-arxiv-blog/462c39db8e7b>

Japanese team demonstrates quantum entanglement over >300km.

http://www.technologyreview.com/view/520886/japanese-telco-smashes-entanglement-distance-record/?utm_campaign=socialsync&utm_medium=social-post&utm_source=twitter&utm_content=arxiv

Physicists demonstrate first use of quantum teleportation to send information to a solid-state memory.

http://www.technologyreview.com/view/524186/quantum-internet-first-teleportation-to-a-solid-state-quantum-memory/?utm_campaign=socialsync&utm_medium=social-post&utm_source=twitter&utm_content=arxiv

Ideas for teleporting energy exploiting quantum effects.

http://www.technologyreview.com/view/523716/energy-teleportation-overcomes-distance-limit/?utm_campaign=socialsync&utm_medium=social-post&utm_source=twitter&utm_content=arxiv

IARPA pursues 'superconducting supercomputer' to lower power consumption: 'Studies indicate that superconducting supercomputers may be capable of 1 PFLOP/s for about 25 kW and 100 PFLOP/s for about 200 kW.' [The current fastest supercomputer uses about 200 times more energy than this per calculation, cf. p. 39 of my essay.]

<http://www.iarpa.gov/Programs/ssoc/C3/c3.html>

The hardware revolution.

Open source design allows the reuse of trusted IP. It has become cheaper and easier to make prototypes. Before, companies did mass manufacturing then did sales and marketing but now they do marketing and pre-sales before mass manufacturing, helped by 'crowdfunding'.

<http://blog.upverter.com/what-is-the-hardware-revolution>

4. Biological engineering.

Latest details on the cost of genetic sequencing - now approaching \$1,000 per genome, a million-fold reduction over a decade.

http://www.synthesis.cc/cgi-bin/mt/mt-search.cgi?blog_id=1&tag=Carlson+Curves&limit=20

Marcus Covert (Stanford) is building a computer simulation of one of the simplest single-celled microbes, the *Mycoplasma genitalium* bacterium, in order to have something simple enough that all known biology could be simulated: the unwiring of every rung of the DNA ladder, the transcription of every message, the manufacture of every enzyme and other proteins, energy flows and metabolism, and all the interactions causing the cell to split into two. Its genome was sequenced by Venter in 1995. It has 525 genes. All available information was gathered and encoded in mathematical formulae and software modules for each process. The 1,700-odd parameters were assigned values from experiment or given upper/lower bounds as guesses. The cell has to duplicate all of its contents every ~9-10 hours, allowing guesses to be made for unknown variables. (Human cells have forty times more genes and the chromosomes are more intricate.)

<http://www.scientificamerican.com/article/scientists-successfully-model-a-living-cell-with-software/>

Carlson essay on biosecurity issues

<http://thebulletin.org/national-security-natural-security#.UqkhhyG40Gs.twitter>

Origins of life.

<http://harvardmagazine.com/2013/09/life-s-beginnings>

<http://www.pnas.org/content/110/33/13236.full>

5. Mind and machine.

Updates on various developments with machine intelligence, including recent breakthroughs in neural networks and neuromorphic chips... After losing favour in the AI community in the 1980s, artificial neuronal networks (ANNs) are now proving successful. E.g. 'The Boltzmann machine', invented by Hinton (he now works at Google): synapses start with random weights; data streams in; the pattern of neurons and synapses firing when given meaningful data (e.g a picture of a car) is compared to random firing activity when the data is turned off; each synapse runs an algorithm that strengthens the synapse if the neurons it connects fire more often when given meaningful data than when given random noise, and weakens the synapse if random noise produces more firing. Then successive layers are built in which each higher level uses as its output the input from the lower level. This allows more sophisticated abstractions to be developed... In 2012, Google created a neural network that taught itself how to recognise pictures on the internet. It was led by Ng (Stanford professor and a founder of Coursera) and had 10^6 neurons and 10^9 synapses. Ng: for \$100,000 in hardware, we can build a 10^{10} -connection network with 64 GPUs. Qualcomm says it will produce commercial neuromorphic chips (where sensors become the computer, processing probabilistically like real neurons) in 2014.

http://www.nytimes.com/2013/12/29/science/brainlike-computers-learning-from-experience.html?ref=todayspaper&_r=0

<https://www.simonsfoundation.org/quanta/20130723-as-machines-get-smarter-evidence-they-learn-like-us/>

Michael Nielsen, author of the standard textbook on quantum computers and of the brilliant book '*Reinventing Discovery*' (cf. Section 6 of my essay), is writing a new book to teach the general reader (with a bit of maths) how to use neural networks. (Please let me know if you hear of a school using it.)

<http://neuralnetworksanddeeplearning.com>

DeepMind Technologies in London created a neural network that learns how to play video games in the same way as humans and can win at games like Pong. [They were bought by Google shortly after this, along with other machine intelligence companies, some of which were deeply involved with DARPA-funded projects.]

<https://medium.com/the-physics-arxiv-blog/bfc25f2ffe03>

Fields Medallist Tim Gowers is building a robot mathematician.

<http://arxiv.org/pdf/1309.4501v1.pdf>

Update on Chris Anderson's drone company

http://spectrum.ieee.org/aerospace/aviation/chris-andersons-expanding-drone-empire?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+IeeeSpectrum+%28IEEE+Spectrum%29

Demo: first autonomous flying robots capable of flocking outdoors

<https://medium.com/the-physics-arxiv-blog/3fef68c1195>

Brain monitoring... Using existing scanners, despite their increasing power we can still only monitor hundreds of neurons on the millisecond timescale necessary to capture core behaviour. One goal, often a sci-fi theme, has long been that we spread tiny electronic devices throughout the brain to gather and digitise almost all neuronal information (i.e on all $\sim 8 \times 10^{10}$ neurons) then beam it outside the skull using radio waves. Today's technology allows wirelessly powered RFID chips as small as 50 micrometres but they still use 100-1000 times too much power for whole-brain monitoring with millisecond resolution. If they shrink further and use much less power, it is feasible that the goal will become achievable. It is even possible that we could engineer neurons to record their own data. As Freeman Dyson said, 'There is no law of physics that declares such an observational goal to be impossible.'

'Simultaneously measuring the activities of all neurons in a mammalian brain at millisecond resolution is a challenge beyond the limits of existing techniques in neuroscience... Based on this analysis, all existing approaches require orders of magnitude improvement in key parameters... Understanding the physical limits of brain activity mapping may provide insight into opportunities for novel solutions. For example, unconventional methods for delivering electrodes may enable unprecedented numbers of recording sites, embedded optical devices could allow optical detectors to be placed within a few scattering lengths of the measured neurons, and new classes of molecularly engineered sensors might obviate cumbersome hardware architectures. We also study the physics of powering and communicating with microscale devices embedded in brain tissue and find that, while radio-frequency electromagnetic data transmission suffers from a severe power-bandwidth tradeoff, communication via infrared light or ultrasound may allow high data rates due to the possibility of spatial multiplexing. The use of embedded local recording and wireless data transmission would only be viable, however, given major improvements to the power efficiency of microelectronic devices.'

<http://syntheticneurobiology.org/PDFs/13.10.marblestone.pdf>

Real US wages have not increased for decades. There is increasing speculation among economists that part of the reason - and a growing influence on the economy - is that substituting capital for labour through automation is increasingly attractive, therefore owners of capital are capturing ever more of the world's income. 'Larry Summers ... looked at employment trends among American men between 25 and 54. In the 1960s only one in 20 of those men was not working. According to Mr Summers's extrapolations, in ten years the number could be one in seven... A 2013 paper by Carl Benedikt Frey and Michael Osborne ... argued that jobs are at high risk of being automated in 47% of the occupational categories into which work is customarily sorted...' Business Insider.

[As automation spreads and the top 1% continue to get richer at a faster rate than the rest, it seems to me likely that there will be growing political pressure for a major economic change - some sort of policy to give all adults a basic salary simply by virtue of being a citizen. Of course, this would also make immigration arguments trickier.]

6. Education

Michael Nielsen on Reinventing Explanation - how can new media be used to teach scientific ideas? 'We learn most when we have the most to lose.' Games / emotional involvement.

http://michaelnielsen.org/reinventing_explanation/index.html

The Calculus Concept Inventory (CCI)

To get beyond 'wars' about teaching methods, we need 'concept inventory tests' like the Force Concept Inventory for Newtonian Mechanics. The CCI is the second (maths one) in a series after

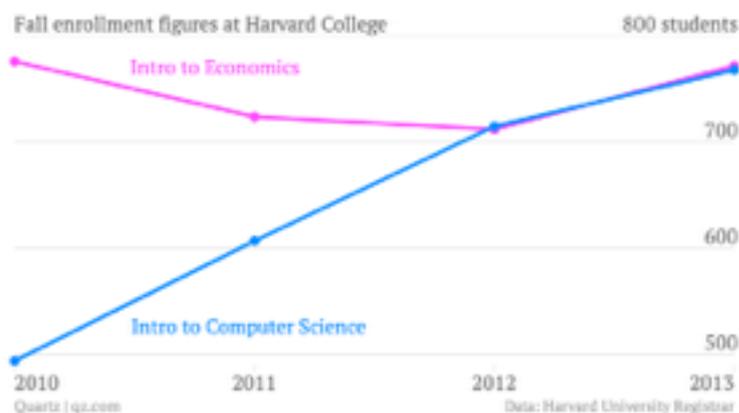
Basic Skills Diagnostic Test; the next one is a planned Algebra Concept Inventory. They test basic conceptual understanding and involve very little calculation. They do not test a whole curriculum. The FCI tests ability to use the basics of Newtonian mechanics. FCI and CCI show that *normal instruction has 'remarkably little effect on basic conceptual understanding'*. FCI has led to changes in physics teaching at some of the best universities because faculty recognise its validity and implications for their teaching. Cf. Section 6 and Endnote of my essay for full discussion: I think that the use of such tests, embedded in a *learning feedback loop* in Academy chains and the broader research community, could make a large difference to standards - see the summary of my essay [here](#). (Many on the Left will oppose CIs because they will reveal widespread failure. Many on the Right will oppose them because they do not support what they think are 'traditional' teaching methods. The progressive/traditionalist label is damaging and needs overcoming.)
<http://www.ams.org/notices/201308/rnoti-p1018.pdf>

Hsu on variance and test scores
<http://infoproc.blogspot.co.uk/2014/02/correlation-and-variance.html>

IARPA's INSIGHT project: 'An integrative system for enhancing fluid intelligence (*Gf*) through human cognitive activity, fitness, high-definition transcranial direct-current brain stimulation, and nutritional intervention'. It supports the SHARP (Strengthening Human Adaptive Reasoning and Problem-solving) program, whose goal is to develop evidence-based tools and methods that can improve the quality of human judgment and reasoning in complex, real world environments. 'INSIGHT will be one of the largest scientific studies investigating fluid intelligence conducted to date: nearly 2,000 individuals organized into four cohorts over a three-and-a-half year period, for more than 100,000 hours of planned data collection. INSIGHT program participants will engage in the training activities over 18 weeks in an effort to improve reasoning and problem solving skills.' [Generally, all attempts at improving general fluid intelligence by training have not succeeded: performance on narrow tasks can be improved by training, but it does not seem to carry over to other tasks in a general way. It will be fascinating to see if IARPA can make a breakthrough here.]
<http://beckman.illinois.edu/news/2014/02/insight>

Hoxby on MOOCs and HE.
<http://papers.nber.org/tmp/43484-w19816.pdf>

'Introduction to Computer Science' (CS50) is widely regarded as the hardest course at Harvard. A decade ago, only 112 students took it. Since then, it has risen to about 800 - the same as Introduction to Economics. Very good news.



<http://www.thecrimson.com/article/2013/9/12/course-enrollment-numbers-CS50/>

Grafton on problems with UK Universities (2010).

<http://www.nybooks.com/blogs/nyrblog/2010/mar/09/britain-the-disgrace-of-the-universities/>

Judt on education, King's, elitism

<http://www.nybooks.com/articles/archives/2010/aug/19/meritocrats/?pagination=false#fn4-76325709>

Chains and Bill Gates' new Africa project. We need much more of this in the UK.

<http://www.wired.com/design/2013/11/schoolinabox/>

Cambridge course - The Master's in Public Policy (MPP).

<http://www.polis.cam.ac.uk/Graduates/ProsMPhil/MPhilPP/programme-description>

A major new study on social mobility. [One of the many things that unfortunately few realise is that when one considers adopted children, their life chances are more strongly predicted from their biological parents than their adoptive families; the correlation between the adopting parents and the adopted child (tested as an adult) on IQ tests is *almost zero*; and the correlation between the incomes and educational attainment of adopted children and those of their adoptive parents is low. People make a common mistake, encouraged by many sociologists and economists: they assume that most of the ways that advantages are passed on to children are *environmental* therefore they think that high parent-child correlations are evidence of a lack of social mobility. This view is *not* consistent with the science. But, however the genetic science plays out as we discover more and more, it in no way justifies spending less money on the education of the poor; indeed, it could easily be used to justify *more* spending on the poor. It is reasonable for people to worry about new forms of Social Darwinism given the 20th Century but it is not sensible to adopt an anti-scientific attitude simply because science undermines traditional assumptions and beliefs, in this area now as it did in other areas in the past. This debate may change when people on the Left realise that the lottery aspect of people's success could be used to justify *more* redistribution. The Right will worry about the loss of 'responsibility'.]

'When you look across centuries, and at social status broadly measured — not just income and wealth, but also occupation, education and longevity — social mobility is much slower than many of us believe, or want to believe. This is true in Sweden, a social welfare state; England, where industrial capitalism was born; the United States, one of the most heterogeneous societies in history; and India, a fairly new democracy hobbled by the legacy of caste. Capitalism has not led to pervasive, rapid mobility. Nor have democratization, mass public education, the decline of nepotism, redistributive taxation, the emancipation of women, or even, as in China, socialist revolution... To a striking extent, your overall life chances can be predicted not just from your parents' status but also from your great-great-great-grandparents'...

'50 to 60 percent of variation in overall status is determined by your lineage. The fortunes of high-status families inexorably fall, and those of low-status families rise, toward the average — what social scientists call "regression to the mean" — but the process can take 10 to 15 generations (300 to 450 years), much longer than most social scientists have estimated in the past...

'We can't know for certain what the mechanism of that inheritance is, though we know that genetics plays a surprisingly strong role. Alternative explanations that are in vogue — cultural traits, family economic resources, social networks — don't hold up to scrutiny.

'We found that late medieval England was no less mobile than modern England — contrary to the common assumption of a static feudal order. It took just seven generations for the successful descendants of illiterate village artisans of 1300 to be incorporated fully into the educated elite of 1500 — that is, the frequency of their names in the Oxbridge rolls reached the level around where

it is today... For all the creative destruction unleashed by capitalism, the industrial revolution did not accelerate mobility. Looking at 181 rare surnames held by the wealthiest 15 percent of English and Welsh people in the mid-19th century — to be clear, these were not the same elite surnames as in the medieval era — we found that people with these surnames who died between 1999 and 2012 were more than three times as wealthy as the average person. If your surname is rare, and someone with that surname attended Oxford or Cambridge around 1800, your odds of being enrolled at those universities are nearly four times greater than the average person. This slowness of mobility has persisted despite a vast expansion in public financing for secondary and university education, and the adoption of much more open and meritocratic admissions at both schools...

‘Evidence has been found that programs from early childhood education to socioeconomic and racial classroom integration can yield lasting benefits for poor children. But the potential of such programs to alter the overall rate of social mobility in any major way is low. The societies that invest the most in helping disadvantaged children, like the Nordic countries, have produced absolute, commendable benefits for these children, but they have not changed their relative social position.

‘... the large investments made by the super-elite in their kids — like those of the Manhattan hedge-funders who spend a fortune on preschool — are of no avail in preventing long-run downward mobility... As long as mating is assortative — partners are of similar social status, regardless of ethnic, national or religious background — social mobility will remain low. [And isn't assortative mating *increasing*, not shrinking?]

‘Large-scale, rapid social mobility is impossible to legislate. What governments can do is ameliorate the effects of life's inherent unfairness. Where we will fall within the social spectrum is largely fated at birth. Given that fact, we have to decide how much reward, or punishment, should be attached to what is ultimately fickle and arbitrary, the lottery of your lineage.’

<http://opinionator.blogs.nytimes.com/2014/02/21/your-fate-thank-your-ancestors/?action=click&contentCollection=Opinion&module=MostEmailed&version=Full®ion=Marginalia&src=me&pgtype=article>

All interested in this debate should also read a fascinating paper by the world-leading expert Professor Plomin - '*Genetic influence on family socioeconomic status and children's intelligence*' - using a cutting-edge technique 'Genome-wide Complex Trait Analysis'. '[K]ey aspects of children's environment such as socioeconomic status (SES) cannot be investigated in twin studies because they are the same for children growing up together in a family. Here, using a new technique applied to DNA from 3000 unrelated children, we show significant genetic influence on family SES, and on its association with children's IQ at ages 7 and 12. In addition to demonstrating the ability to investigate genetic influence on between-family environmental measures, our results emphasize the need to consider genetics in research and policy on family SES and its association with children's IQ.'

<http://www.sciencedirect.com/science/article/pii/S0160289613001682>

Also cf. this paper on class / SES / IQ.

<http://uwf.edu/spbs/prp/articlelist/Genetic%20Effects%20on%20Adult%20Intelligence.pdf>

Some data on IQ scores by different discipline: maths, physics and philosophy score substantially higher (~1SD) than social scientists.

<http://www.religjournal.com/pdf/ijrr10001.pdf>

<http://www.statisticbrain.com/iq-estimates-by-intended-college-major>

<http://blogs.discovermagazine.com/gnxp/2010/12/verbal-vs-mathematical-aptitude-in-academics/#.UxsYvnn8pMI>

This paper: 'low-income students have made substantial gains in their academic course achievements since the 1970s. Nonetheless, wealthier students have made even stronger gains in achievement over the same period, in both courses and test scores, ensuring a competitive advantage in the market for selective college admissions. Thus, even if low-income students were "perfectly matched" to institutions consistent with their academic achievements, the stratification order would remain largely unchanged.'

<http://www-personal.umich.edu/~bastedo/papers/BastedoJaquette2011.pdf>

Social mobility in UK

<http://drjamesthompson.blogspot.co.uk/2013/09/social-mobility.html?m=1>

[Some of those on Left and Right who are unhappy about the heritability of intelligence complain about twin and adoption studies. Leaving aside the fact that scientists accept these studies in all sorts of fields including epidemiology, and the complaints raised in the media after my essay are not shared by hard scientists, one no longer has to rely just on those studies *because the numbers produced by them have been confirmed by studies of actual DNA* in Genome Wide Association Studies.]

Re the QTS debate. Do you think that MPs plus DfE (having to deal with Clegg's and others' political interventions) are more likely to a) devise and implement a good system - 'a guarantee of a basic standard' - that raises quality and minimises bureaucracy or b) devise a bad system and implement it badly, lowering quality and increasing bureaucracy? (Consider as context the damaging influence of Clegg on the UFSM policy: do you want processes like that deciding new QTS standards, because that's what you'd get?) Even if you think A, do you think this system is more likely to persist or to be weakened because of political initiatives? Many want evidence-led teacher standards connected to hiring, remuneration, and firing. The question is whether this is more likely to come top-down from Westminster or bottom-up from the system, and which is more likely to be healthier in the long-term. Gove's team prefers bottom-up, which is why we did what we did on QTS. A lot of trial and error is necessary to get such standards right and integrate them with other HR systems. Imposing a central framework would either be so vague as to be otiose or so detailed as to be damaging.

Although Gove's critics often say 'leave us alone' they rarely mean it - they usually mean 'you [insert favourite MP with dictatorial psychology] should impose my pet project on the system now'. E.g. when we scrapped Levels, the unions complained; when we scrapped the January window for A Level exams and the modular treadmill, the unions complained. Whenever the unions are asked for bureaucracy to remove, they do not come up with anything because they do not seem bothered by bureaucracy *per se*. Union reaction often is so incoherent it amounts to 'we hate you interfering with us, how dare you STOP interfering with us, we demand you KEEP interfering with us, it's an INSULT you don't want to interfere with us...' It is a sign of the lack of true professionalism in teaching that there are such widespread demands by teachers for their profession to be kept politicised rather than entrusted to the profession itself. Politically, I suspect people will listen to the argument - 'state schools should be able to hire staff from private schools who don't have a bit of paper cooked up by MPs which does not guarantee quality.'

Training and tools

How Netflix reinvented HR. Very interesting (as was feedback from senior civil servants on how hard it would be to make similar changes in Whitehall, when I sent them this).

<http://hbr.org/2014/01/how-netflix-reinvented-hr/ar/pr>

Palantir's application of network science to technology. Surely someone somewhere is using this for opposition research in a political campaign...

<http://www.wired.co.uk/magazine/archive/2012/09/features/joining-the-dots/viewall>

Special forces changes.

Pre-9/11, SOF was configured to do very few operations with a lot of intel and huge secrecy. This model could not cope with post-9/11. McChrystal introduced the F3EA cycle: find (who is target), fix (locate), finish (kill/capture), exploit (take what intel you can), analyse (where does intel lead). A fundamental goal was to transform SOF so that it could repeat this cycle much faster. In August 2004, there were 18 raids. By August 2006, there were 300 per month (ten per night). By 2006, operations at the end of the night targeted people nobody had heard of at the start of the night. This required radical decentralisation and connection across the network including much more information-sharing horizontally. This requires a different approach to classification and creates cultural resistance. Technologically, GPS meant 'getting there' became a much reduced problem. Night vision allowed no-light operations which was a big advantage. Drones plus high bandwidth video improved situational awareness and therefore allowed reduction in teams from 120 (to do all the perimeter guarding etc) to 20, so therefore more operations per night were possible. [A difference in speed becomes a qualitative difference. Someone will radically decentralise and speed up political warfare in the UK but probably not before the 2015 election; existing party leaderships are not equipped to deal with the psychological or management changes necessary.]

http://www.foreignaffairs.com/discussions/interviews/generation-kill?cid=emc-dec13promoh-content-120313&sp_mid=44509480&sp_rid=YVxleGpyYXkyMDAyQGhvdGIhaWwuY29tS0

'Virality prediction and community structure in social networks', Weng et al, Nature, 2013.

7. Political economy

The state of computational social science, by Duncan Watts.

https://www.nae.edu/Publications/Bridge/106112/106118.aspx#.UupmB4_K3Ss.twitter

Arthur on Complexity Economics.

Geithner pre-crisis: 'Financial institutions are able to measure and manage risk much more effectively.' Paulson: 'deep and liquid US capital markets are playing a vital role in maintaining stability.' Trichet re handling the crisis: 'In the absence of clear guidance from existing analytical frameworks, policymakers had to place particular reliance on our experience.' Lucas 2003: 'the problem of the business cycle has effectively been solved.'

<http://tuvalu.santafe.edu/~wbarthur/Papers/Comp.Econ.SFI.pdf>

Summary of the recent fascinating breakthroughs in Iterated Prisoners' Dilemma. (This also shows how mathematicians and physicists invade other fields, though the reverse does not happen.)

<http://www.americanscientist.org/issues/id.16112.y0.no..content.true.page.1.css.print/issue.aspx>

Evolutionary instability of zero-determinant strategies demonstrates that winning is not everything, Adami & Hintze, Nature, 2013.

Towards a richer evolutionary game theory, 2013.

Towards a Proper Assignment of Systemic Risk: The Combined Roles of Network Topology and Shock Characteristics.

As well as thinking about the nodes of the network (e.g. regulation of capital requirements), policy makers should think about the influence of *network topology* (the connections between firms) on behaviour in a crisis. Interconnectedness can help shocks to dissipate but above a certain threshold

it can also make things worse. Modularity can improve robustness but globalisation has reduced modularity of the financial network. The Volcker rule - quarantining hedge funds, proprietary trading etc) is an example of enhanced modularity.

<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0077526>

The Ultimatum game.

http://people.fas.harvard.edu/~drand/rand_2013_pnas.pdf

Networks and early warning of topological collapse.

<http://www.nature.com/srep/2013/131128/srep03357/full/srep03357.html>

Reverse diasporas.

<http://www.wired.com/opinion/2013/11/software-is-reorganizing-the-world-and-cloud-formations-could-lead-to-physical-nations/>

Interview with Walter Laqueur on the decline of Europe.

<http://www.spiegel.de/international/europe/interview-with-historian-walter-laqueur-on-the-decline-of-europe-a-912837.html>

Harford on tragedy of commons and Ostrom.

<http://timharford.com/2013/08/do-you-believe-in-sharing/>

Dominic Cummings

28 February 2014