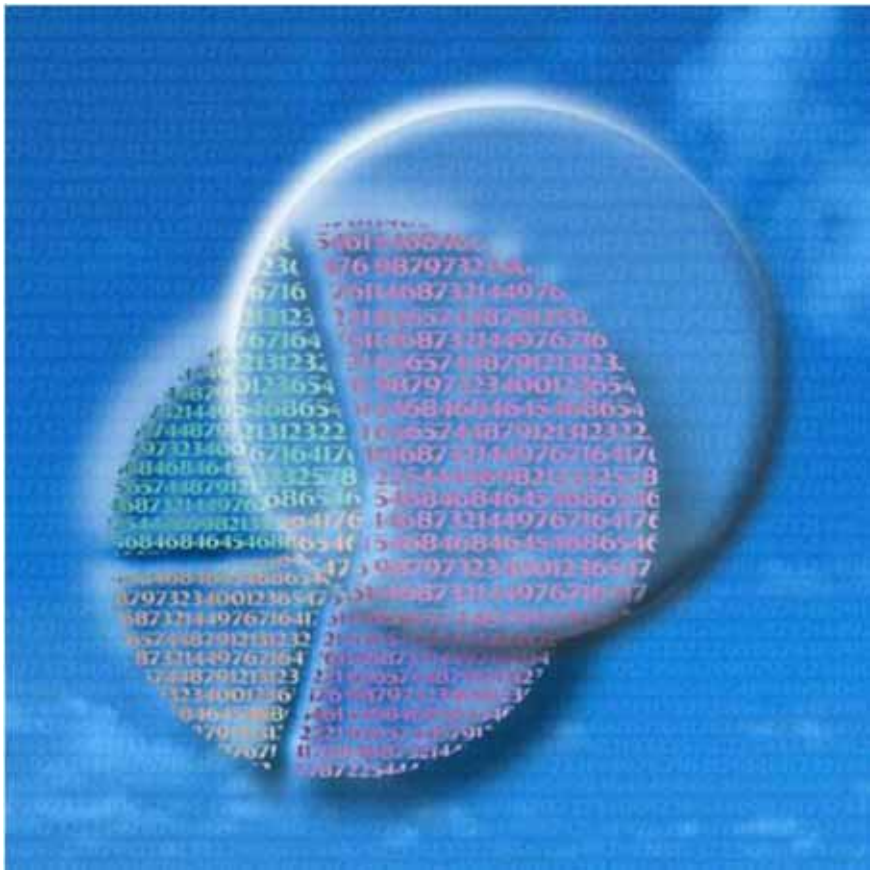


Special times for statisticians

Conference of statistical stakeholders
November 24th 25th 2014
Rome

Andrea Saltelli
European Commission - Joint Research Centre (JRC)
Unit of Econometric Analysis and Statistics
andrea.saltelli@jrc.ec.europa.eu

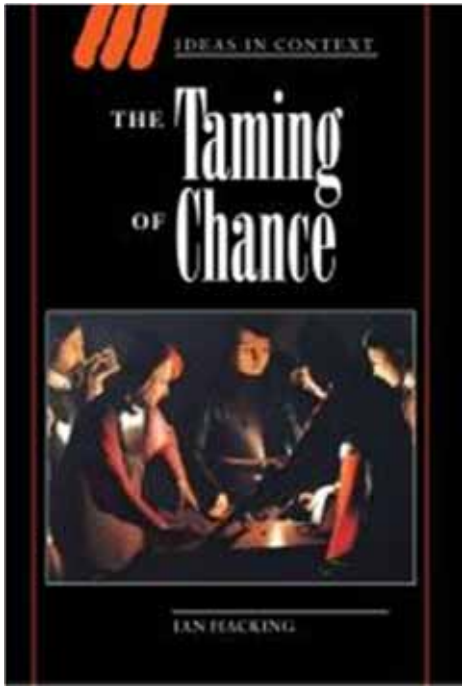
Times ripe with controversy …
Policy decision needs facts, mainly statistical in nature …

Since we look at facts mostly through the lenses of statistics …

European Commission

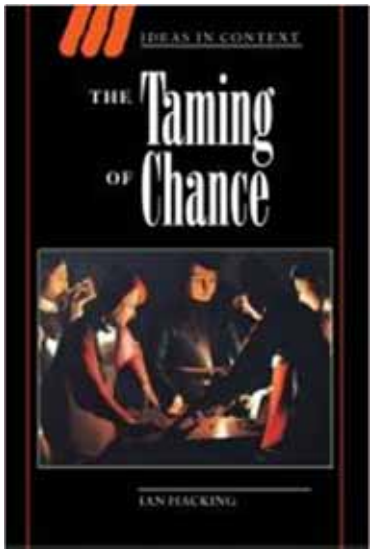
Ian Hacking and the 'imperialism of probability', since probability 'won' between the XVIII and XIX centuries...

Ian Hacking



Today's victory of probability is metaphysical (quantum mechanics), epistemological (statistics as a way of knowing things), logical (statistical inference methods) and ethical (no decision taken without statistical evidence)

Ian Hacking



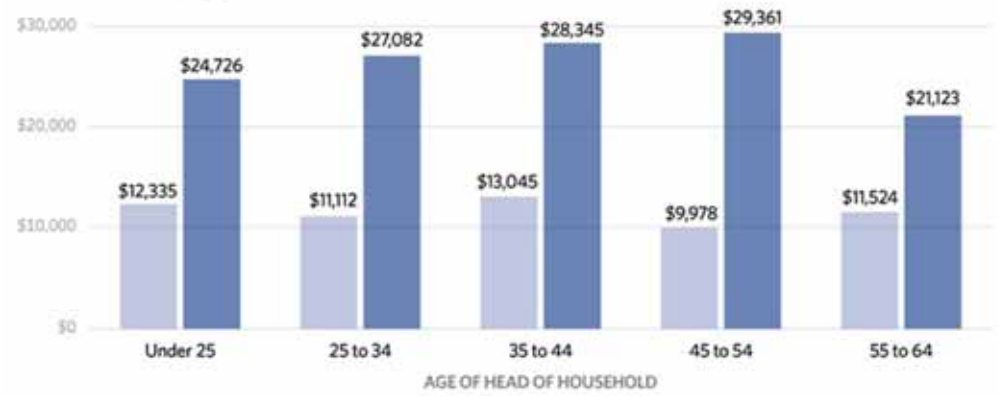
Times of controversy: ‘wicked’ issues: GMO’s, climate, Bees and pesticides, Shale gas fracking, Coolant for Mercedes-Benz, endocrine disruptors, badger culling, …

European Commission

… from the fate of children raised by gay parents to the true long term cost of citizenship for illegal migrants in the US … and all are 'fought' in statistics

CHART 7

Benefits Received and Taxes Paid by Unlawful Immigrant Households, by Age of Head of Household



Note: Benefits include direct and means-tested benefits, public education, and population-based services. Lawful residents are included in these figures.
Source: Heritage Foundation calculations based on data from the U.S. Census Bureau, 2010 Current Population Survey, and U.S. Bureau of Labor Statistics, 2010 Consumer Expenditure Survey. Summaries of data sets are provided in the Appendix.

SR 133 heritage.org

Joint Research Centre

Times of dwindling trust in scientific evidence;

A tsunami in trust and legitimacy has invested science in its entirety, which has statistics as focal, friction point.

European Commission

Issues with trust / quality in the scientific enterprise

Joint Research Centre

Issues with trust / quality in the scientific enterprise

- “Science still commands enormous—if sometimes bemused—respect. But its privileged status is founded on the capacity to be right most of the time and to correct its mistakes when it gets things wrong. […] The false trails laid down by shoddy research are an unforgivable barrier to understanding”

The Economist, October 19, 2013, How Science goes wrong, p. 11.

Issues with trust / quality in the scientific enterprise

- Laboratory experiments cannot be trusted without independent verification (Sanderson 2013), rules are proposed to spot “suspected work […in] the majority of preclinical cancer papers in top tier journals” (Begley 2013).

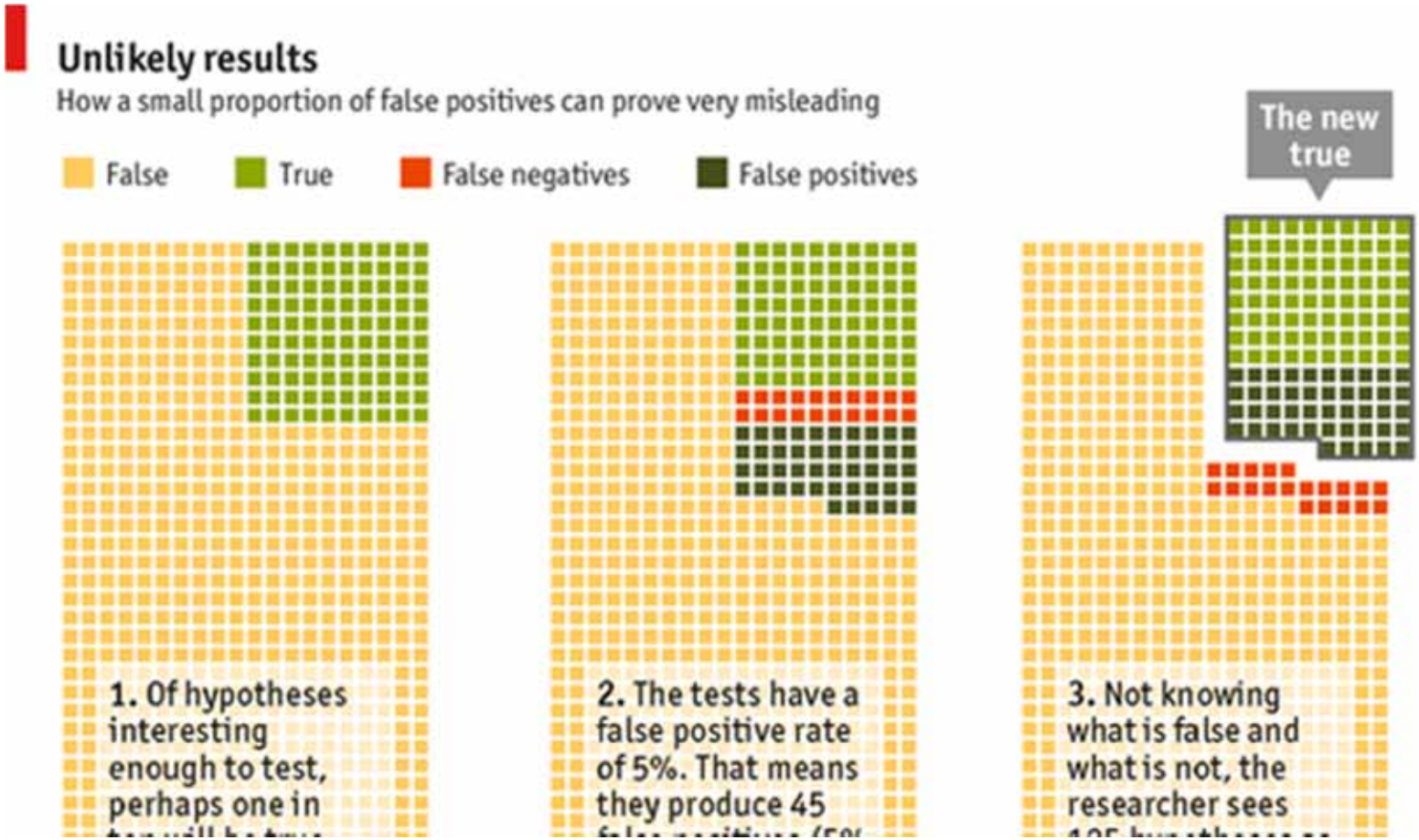
Begley CG 2013 Reproducibility: Six red flags for suspect work Nature 497 433–434.

Ioannidis J P A 2005 Why Most Published Research Findings Are False PLoS Medicine 2(8) 696-701.

Sanderson K 2013 Bloggers put chemical reactions through the replication mill Nature 21 January 2013.

A statistical problem ?

Andrea Saltelli



J. P. A. Ioannidis, Why Most Published Research Findings Are False, PLoS Medicine, August 2005, 2(8), 696-701.

A statistical problem ?

Open access, freely available online

Essay

Why Most Published Research Findings Are False

John P. A. Ioannidis

field. In this framework, a research finding is less likely to be true when the studies conducted in a field are smaller; when effect sizes are smaller; when there is a greater number and lesser preselection of tested relationships; where there is greater flexibility in designs, definitions, outcomes, and analytical modes; when there is greater financial and other interest and prejudice; and when more teams are involved in a scientific field in chase of statistical significance.

A statistical problem ?

Open access, freely available online

Essay

Why Most Published Research Findings Are False

John P. A. Ioannidis

outcomes, and analytical modes; when there is greater financial and other interest and prejudice; and when more teams are involved in a scientific field in chase of statistical significance.

Issues with trust / quality in the scientific enterprise

- Science/knowledge degenerates when it becomes a commodity for Lyotard (1979) and Mirowski (2011).

Jean-François Lyotard

Philip Mirowski

Lyotard, J.-F. 1979. La Condition postmoderne. Rapport sur le savoir, Paris : Minuit, Chapter 10.

Mirowski, P. 2011. Science-Mart: Privatizing American Science, Harvard University Press.

Issues with trust / quality in the scientific enterprise

- A Meta-Research Innovation Centre launched at Stanford (METRICS) to combat ‘bad science’.

- “85% of research funding ‘wasted’ …”

The Economist, 2013, March 15, Combating bad science Metaphysicians. Sloppy researchers beware. A new institute has you in its sights.

Ioannidis, J. P. (2014). How to Make More Published Research True. PLoS medicine, 11(10), e1001747.

Issues with trust / quality in the scientific enterprise

- The centrality of ethics for quality (1971).

"Two separate factors are necessary for the achievement of worthwhile scientific results: a community of scholars with shared knowledge of the standards of quality appropriate for their work and a shared commitment to enforce those standards by the informal sanctions the community possesses; and individuals whose personal integrity sets standards at least high as those required by their community.

Jerome R. Ravetz

Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p.22.

“Shoddy science” is not confined to natural sciences: social sciences are also affected; “I see a train wreck looming” warns Daniel Kahneman; Joseph Stiglitz condemns perverse incentives in the modelling of financial products at the hearth of the present crisis.

Daniel Kahneman

Joseph Stiglitz

Yong, E., Nobel laureate challenges psychologists to clean up their act, Nature, News, 03 October 2012.
Stiglitz, J. (2010) Freefall, Free Markets and the Sinking of the Global Economy, Penguin, London.

The Reinhart and Rogoff affair

Andrea Saltelli

THE NEW YORKER

"Carmen Reinhart and Kenneth Rogoff […] famous (now infamous) research that conservative politicians around the world had seized upon to justify pennypinching Policies …"

John Cassidy, April 2013 issue

The Reinhart and Rogoff affair

Andrea Saltelli

"… rising levels of government debt are associated with much weaker rates of economic growth, indeed negative ones …"

It was instead a coding error uncovered by three researchers at the university of Michigan.

"In Britain and Europe, great damage has been done as a result."

THE NEW YORKER

The Reinhart and Rogoff affair

Andrea Saltelli

European Commission

Perils of placing faith in a thin theory

By Wolfgang Münchau April 21, 2013

Reinhart and Rogoff told policy makers what they wanted to hear

John Kenneth Galbraith [about] Milton Friedman: “Milton’s misfortune was that his policies had been tried.” […]

As for Profs Reinhart and Rogoff, I suspect that they, too, will be mostly remembered for the fact that their policies have been tried.

Joint Research Centre

Excel horror stories and warnings

Andrea Saltelli

"The fact that software is commercial is no guarantee that it does what it's supposed to do" (Philip B. Stark)

http://www.stat.berkeley.edu/~stark/Preprints/auditingPosition09.htm#excel

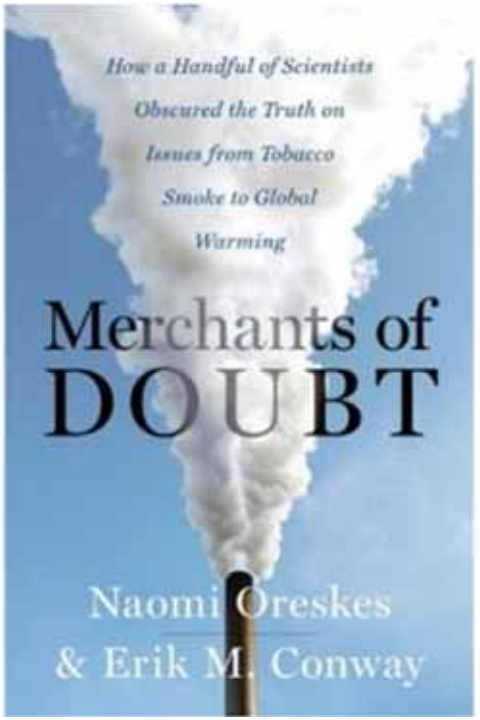
Philip B. Stark

Times where uncertainty is routinely fabricated or concealed by opposing factions

Many data based stories: Tobacco & health, capital punishment & crime rate …

Oreskes, N., Conway E. M., 2010, Merchants of Doubt, Bloomsbury Press

Leamer, E. E., Tantalus on the Road to Asymptopia, 2010, Journal of Economic Perspectives, 24, (2), 31–46.



Erik Conway Naomi Oreskes

Times which call for new models for the use of statistical evidence

Statistics for policy: three models

A rational-positivist model for the use of indicators and policy (good quality statistics underpin good policies)

A Discursive-interpretive model (statistics contribute to a process of framing of and focusing on an issue among the many competing for public's attention)

A Strategic model (statistics is used by parties competing for a given constituency).

Boulanger, P-M., Political uses of social indicators: overview and application to sustainable development indicators. International Journal of Sustainable Development, 10 (1,2):14-32, 2007.

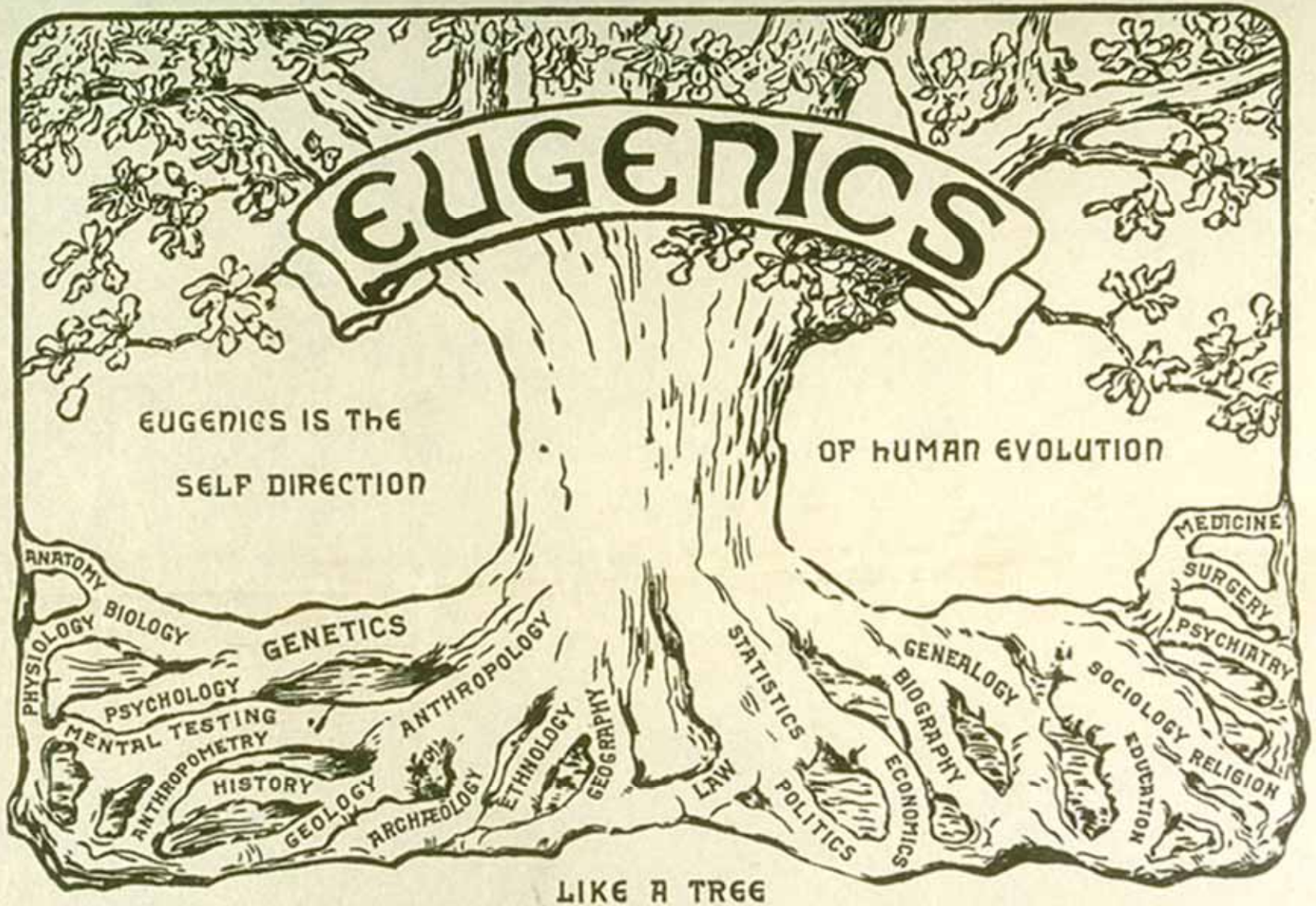
Strategic model (statistics is used by parties competing for a given constituency). The example of the Bush - Gore debate …

G.W.Bush:

‘I'm beginning to think not only did he invent the Internet, but he invented the calculator. It's fuzzy math’

Andrea Saltelli

Even in statistics: is it possible to disentangle evidence based policy from policy based evidence?

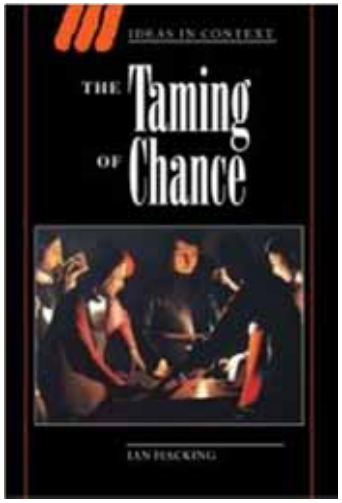


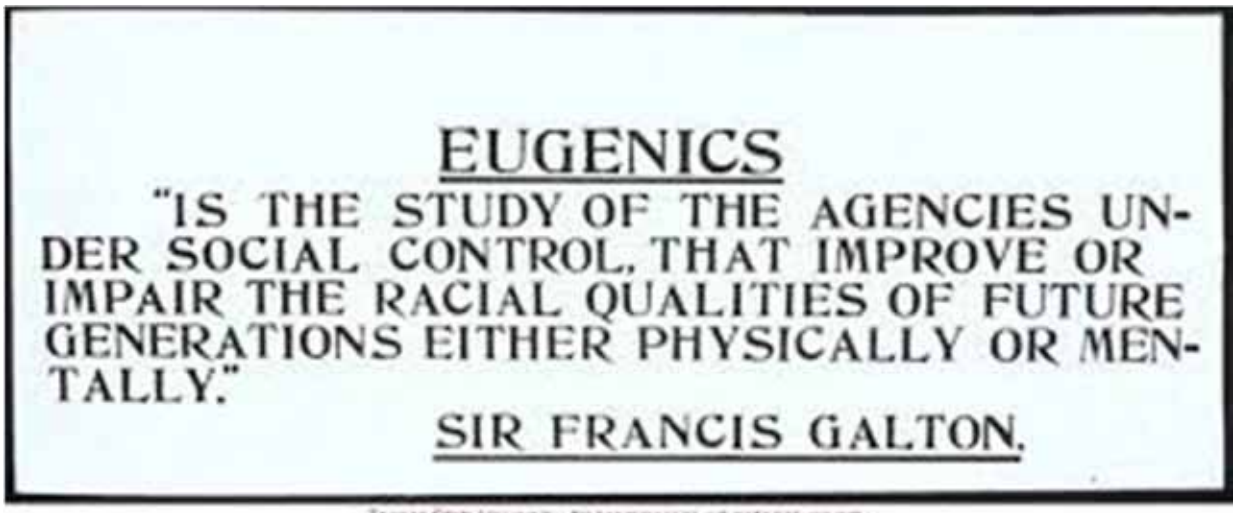
LIKE A TREE

EUGENICS DRAWS ITS MATERIALS FROM MANY SOURCES AND ORGANIZES THEM INTO AN HARMONIOUS ENTITY.

European Commission

Francis Galton and Karl Pearson (the one of chi-squared, of the first university statistics department…) and their laboratory of biometrics … distinguishing army officers from private soldiers from criminals convicted of murder from non-violent felons from Jews …



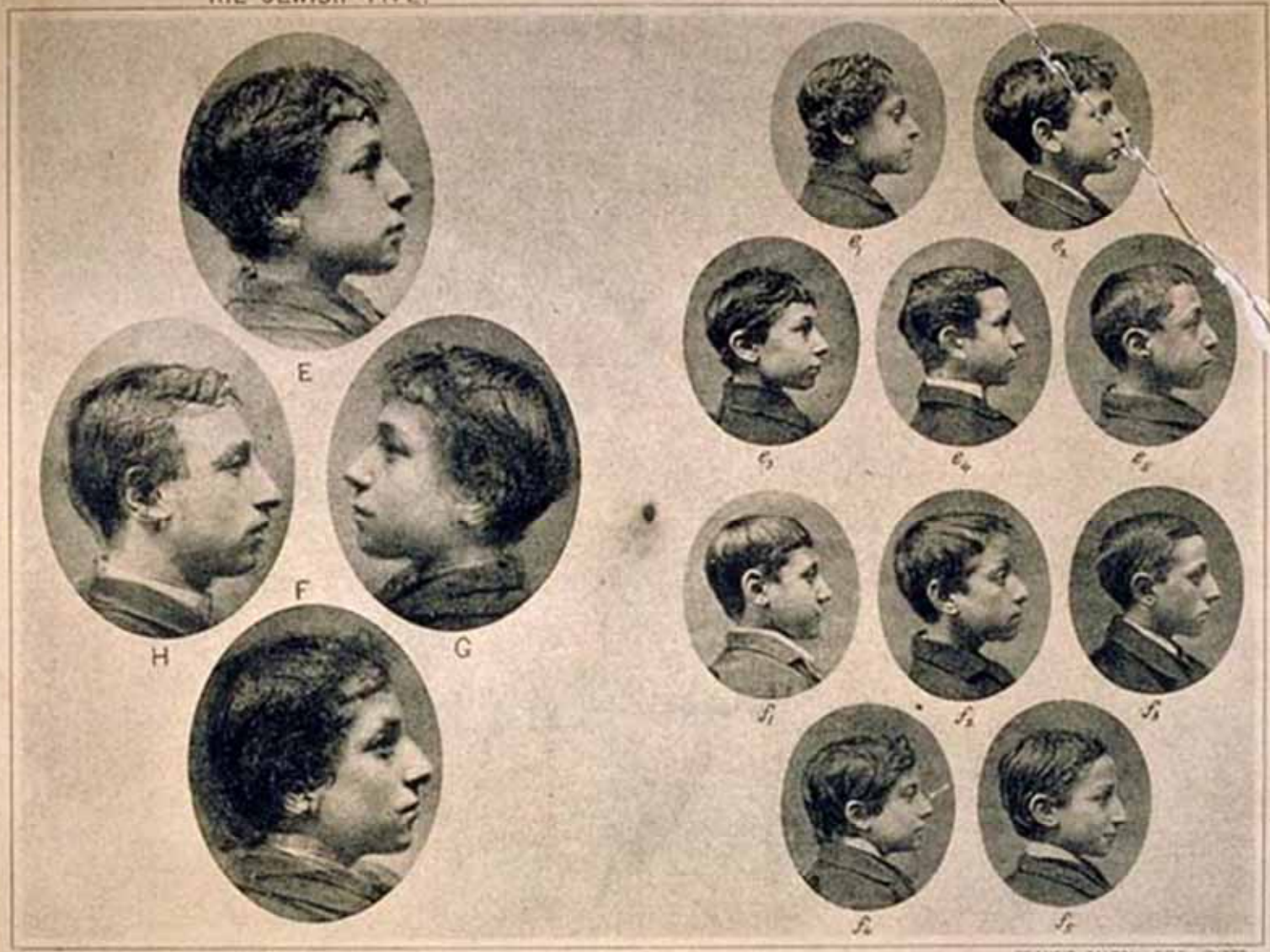


Joint Research Centre

SUPPLEMENT TO "THE PHOTOGRAPHIC NEWS" 17TH APRIL 1885.

THE JEWISH TYPE.

Profile.



FRANCIS GALTON, F.R.S. PHOTO.

COMPOSITES.

Components.

ILLUSTRATIONS OF COMPOSITE PORTRAITURE.

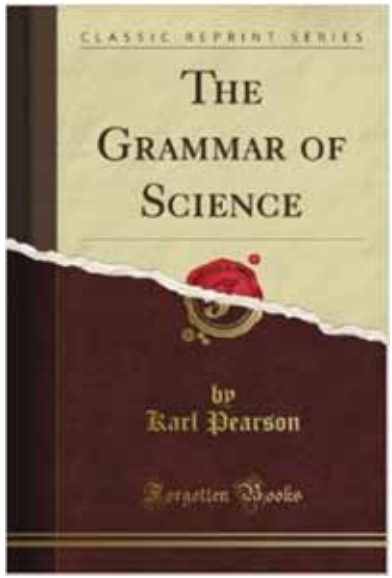
The story of the first R&D Statistics ever. Benoît Godin (2010) tells us what these researchers thought: Measuring the numbers of sons and daughters of scientists will tell us whether a society degenerates toward stupidity.

Godin, B., From Science to Innovation, INRS, Montreal, Canada, Communication presented to the Government-University-Industry Research Roundtable (GUIRR) US National Academy of Sciences, Washington, May 21, 2010.

Karl Pearson (a social Darwinist) suggests not wasting resources on social programs as:

"No degenerate and feeble stock will ever be converted into healthy and sound stock by the accumulated effects of education, good laws, and sanitary surroundings"

Karl Pearson



Pearson, K., 1892, The Grammar of Science, Walter Scott Publisher, London, p.32.

Ravetz uses this example to falsify the naïve belief that "'scientific method' can be applied in a simple and straightforward fashion to [practical] problems", Ravetz, J., Op. Cit., p.346

All this to say that in fact you cannot separate evidence based policy from policy based evidence.

Separating the evidence for the policy: the 'demarcation model' of science's input to policy.

‘Demarcation model’ of science’s input to policy.

- Protecting science from the political interference…
- Possible abuse of science...
- Scientific information driven by agendas...
- A clear demarcation between the institutions (and individuals) who provide the science, and those where it is used, is needed.

Silvio Funtowicz

Funtowicz, S. 2006. What is Knowledge Assessment? In Guimarães Pereira, Â., Guedes Vaz, S. and Tognetti, S. (eds) Interfaces between Science and Society. Greenleaf Publishers, Sheffield.

On demarcation:

"the incoming commission must find better ways of separating evidence-gathering processes from the 'political imperative'", A. Glover, former Chief Science Adviser of President Barroso (Wildson, 2014).

Anne Glover

Wilsdon, J. 2014. Evidence-based Union? A new alliance for science advice in Europe. In The Guardian. Available at: http://www.theguardian.com/science/political-science/2014/jun/23/evidence-based-union-a-new-alliance-for-science-advice-in-europe.

The demarcation model is challenged in modern epistemologies, mostly based on the impossibility to achieve separation between facts and values. Alternatives are offered by ‘Post Normal Science’ (Funtowicz and Ravetz, 1991, 1992, 1993) and by the ‘Co-production of knowledge’ (Jasanoff, 1996) models.

Funtowicz, S. O., & Ravetz, J. R., 1991. A new scientific methodology for global environmental issues. In R. Costanza (Ed.), Ecological economics: The science and management of sustainability (pp. 137–152). New York, NY: Columbia University Press.

Funtowicz, S. O., & Ravetz, J. R. 1992. Three types of risk assessment and the emergence of postnormal science. In S. Krimsky & D. Golding (Eds.), Social theories of risk (pp. 251–273). Westport, CT: Greenwood.

Funtowicz, S. O. & Ravetz, J. R. 1993. Science for the post-normal age. Futures, 25(7), 739–755.

Jasanoff, S. 1996, Beyond Epistemology: Relativism and Engagement in the Politics of Science. Social Studies of Science. 26(2) 393-418.

Some statisticians already advocate teaching PNS for young graduates:

Zidek, J., 2006, Editorial: (Post-normal) statistical science, Journal Royal Statistical Society A, 169(1), 1–4.

James Zidek, University of British Columbia

In the Royal Statistical Society's code of conduct

"little specific guidance concerns conduct in adversarial proceedings, [to tackle] the intersection of values, public policy and science [...] taking place in public view, often adversarial, having a multiplicity of stakeholders and involving concern for accountability (the bottom line!)."

James Zidek

"A partial solution lies in ensuring that statistical education is sufficiently broad to acquaint statistics graduates with the challenges that are presented by PNS."

James Zidek

"[…] In particular, the statistical consulting sequence that is commonly found in statistics graduate programmes might be expanded to include multidisciplinary meetings where a multiplicity of legitimate views are presented in an adversarial context."

James Zidek

"Interest groups have well-honed strategies for exploiting PNS's uncertainty: raising doubts (e.g. confounding and measurement error); asking the wrong questions; making numerous freedom-of-information access requests and using other forms of harassment; re-analysing the data, perhaps with different models or assumptions. There is plenty of scope here for a postnormal statistical scientist!"

James Zidek

End

Andrea Saltelli

Additional slides

An alternative: the Model of Extended Participation from PNS:

- The ideal of rigorous scientific demonstration is replaced by that of open public dialogue…
- "Science" is but one among a plurality of 'relevant knowledges'…
- Citizens become both critics and creators (public engagement, coproduction…)
- Facts become 'extended facts' …

Another feature of PNS: quality as a new organizing principle which “enables us to manage the irreducible uncertainties and ethical complexities” (Funtowicz and Ravetz, 1994).

Funtowicz, S.O. and Ravetz, J.R. (1994). The worth of a songbird: Ecological economics as a post-normal science, Ecological Economics, 10(3), 197-207.

To understand the full scope of the model of extended participation for science's input to policy this should be contrasted with the prevailing wisdom, which is the positivistic model of prediction and control where '*science speaks truth to power*' (Wildavsky, 1979), where the problem are the citizens with their limited understanding of scientific subject ➔ Deficit model; Public understanding of science (PUS).

Wildavsky, A., 1979, Speaking Truth to Power: The Art and Craft of Policy Analysis, Boston Little, Brown and Company.

Expertise and responsibility

- Experts as stakeholders among many, with their occupational psychoses.
- Example: most analyses offered as input to policy are framed as cost benefit analysis (monetization, the occupational psychosis of economists) or risk analyses.
- Techniques (such as CBA) is never neutral; according to Winner (1986) ecologists should not fall into the trap of CBA.

Langdon Winner

Winner, L., 1986. The Whale and the Reactor: a Search for Limits in an Age of High Technology. The University of Chicago Press, 1989 edition.

Frames:

- Frames are never neutral. The example of car accident statistics framed with a focus on the driver and not on the car, or the road.

- “the statistics on road accidents [give] details about the driver (age, gender, speed, alcohol or drugs intake, etc.) but none about the vehicle (age, make and model) or about the road where the accident took place. In other words, the institutions put the emphasis on the “agent-act ratio” excluding implicitly the importance of others elements of the drama such as the scene (road and traffic) and the agency (hazardousness of the vehicle)”, Boulanger, 2014.

Gusfield, J. (1981). The Culture of Public Problems. Drinking-Driving and the Symbolic Order. Chicago : The University of Chicago Press.