Some elements from history and philosophy of science

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Course NANO 310, August-September 2019

Where to find this talk: www.andreasaltelli.eu

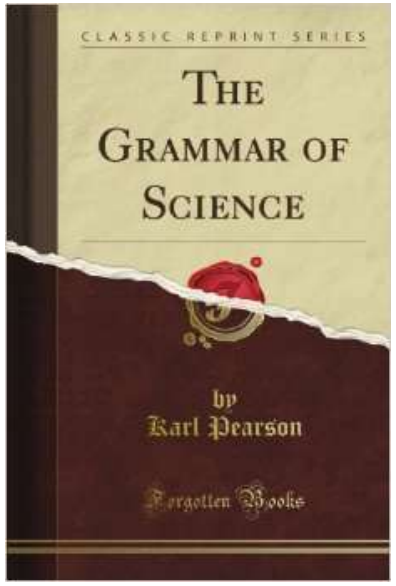
How are we taught our science; the good and the truth; from the Vienna circle to …

How are we taught our science?

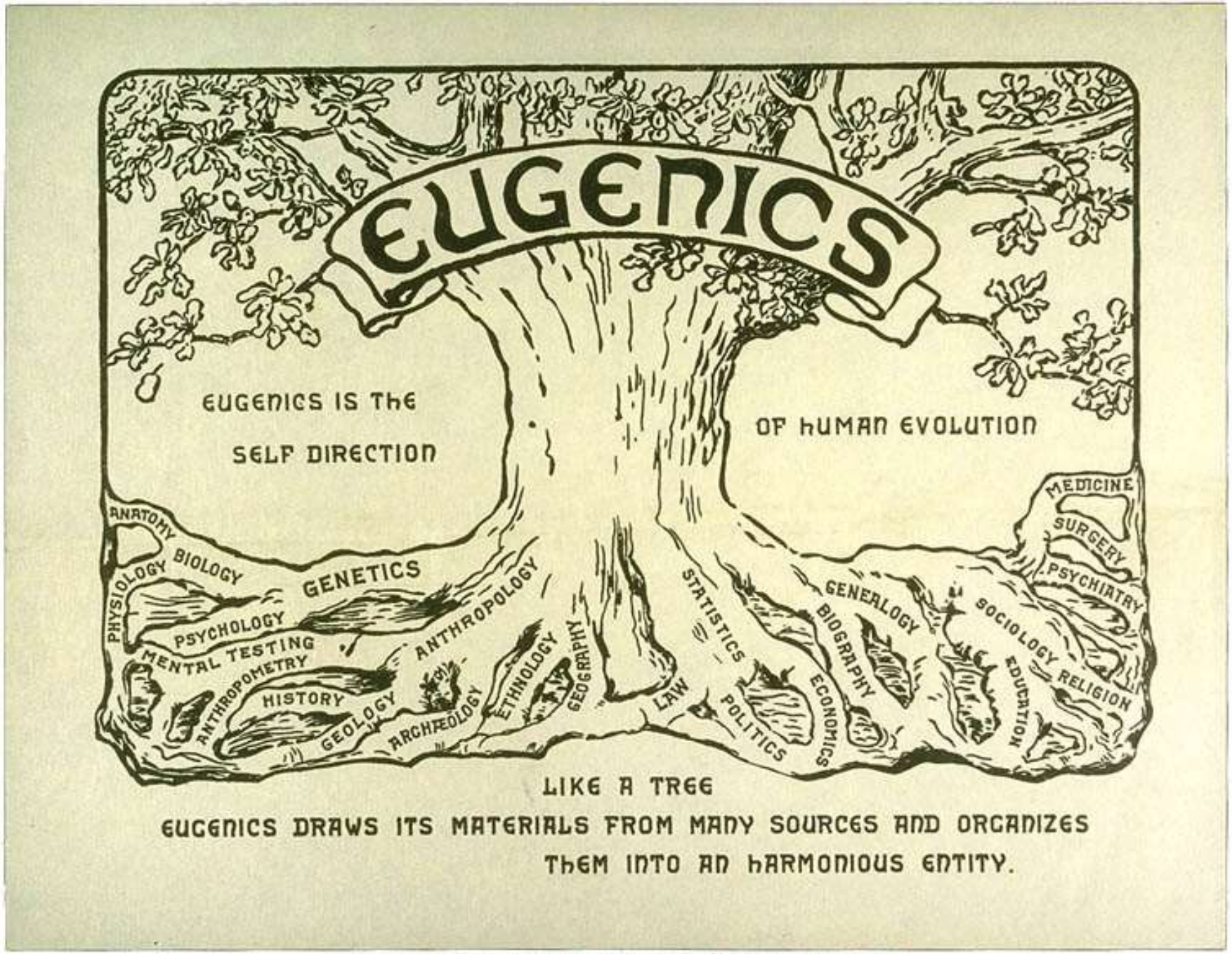
Karl Pearson (a social Darwinist) suggests not wasting resources on social programs as:

"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

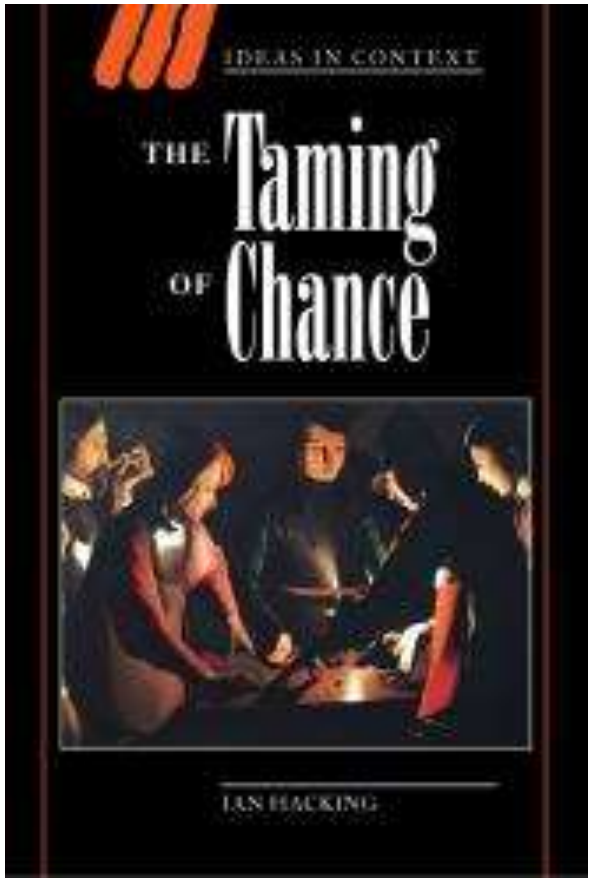


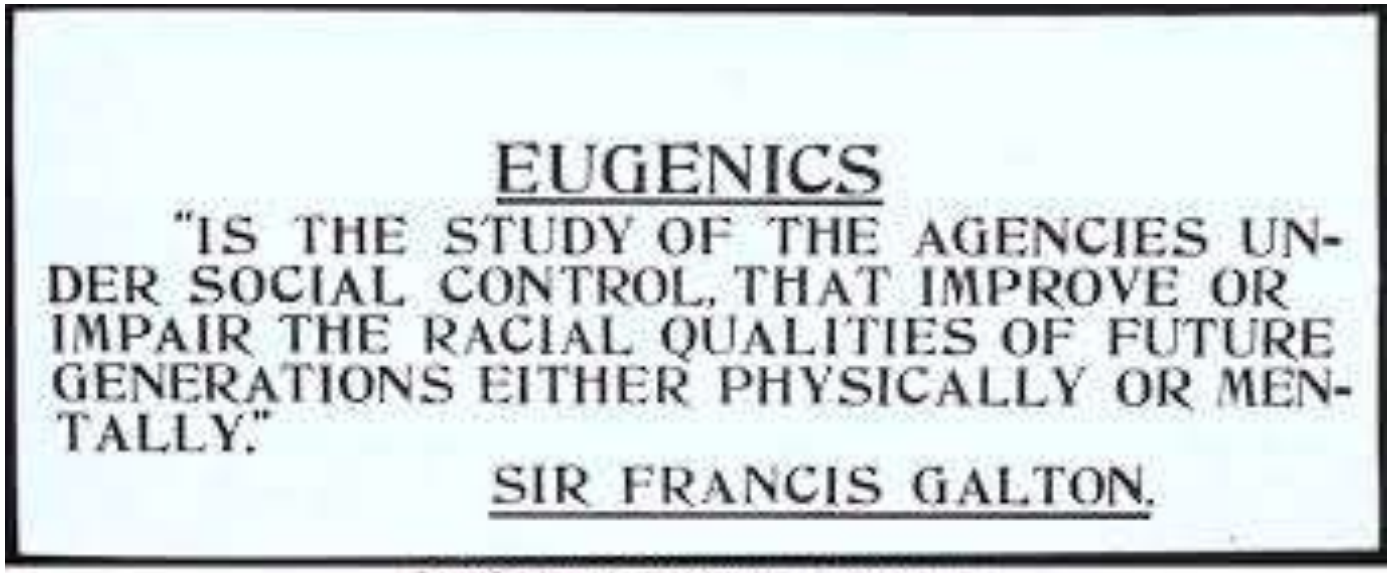
Pearson, K., 1892, The Grammar of Science, Walter Scott Publisher, London, p.32.



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

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





The Jewish type …

EUGENICS

C. P. IVES, Jr. Managing Editor CHARLES McALPIN PYLE, Business Manager

"Eugenics is the study of all of the agencies under social control which may improve or impair the inborn qualities of future generations of men, either physically or mentally."

—Francis Galton

VOLUME II AUGUST 1929 NUMBER 8

The first R&D Statistics ever, by Francis Galton (1822-1911)

Measuring the numbers of sons and daughters of ‘great men of science’ will tell us whether a society degenerates toward stupidity (Benoît Godin, 2010)

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.

Kuhn said that the “educational initiation that prepares and licenses the student for professional practice… is both rigorous and rigid”

and “It is a narrow and rigid education [in physics/science], probably more so than any other except perhaps in orthodox theology”

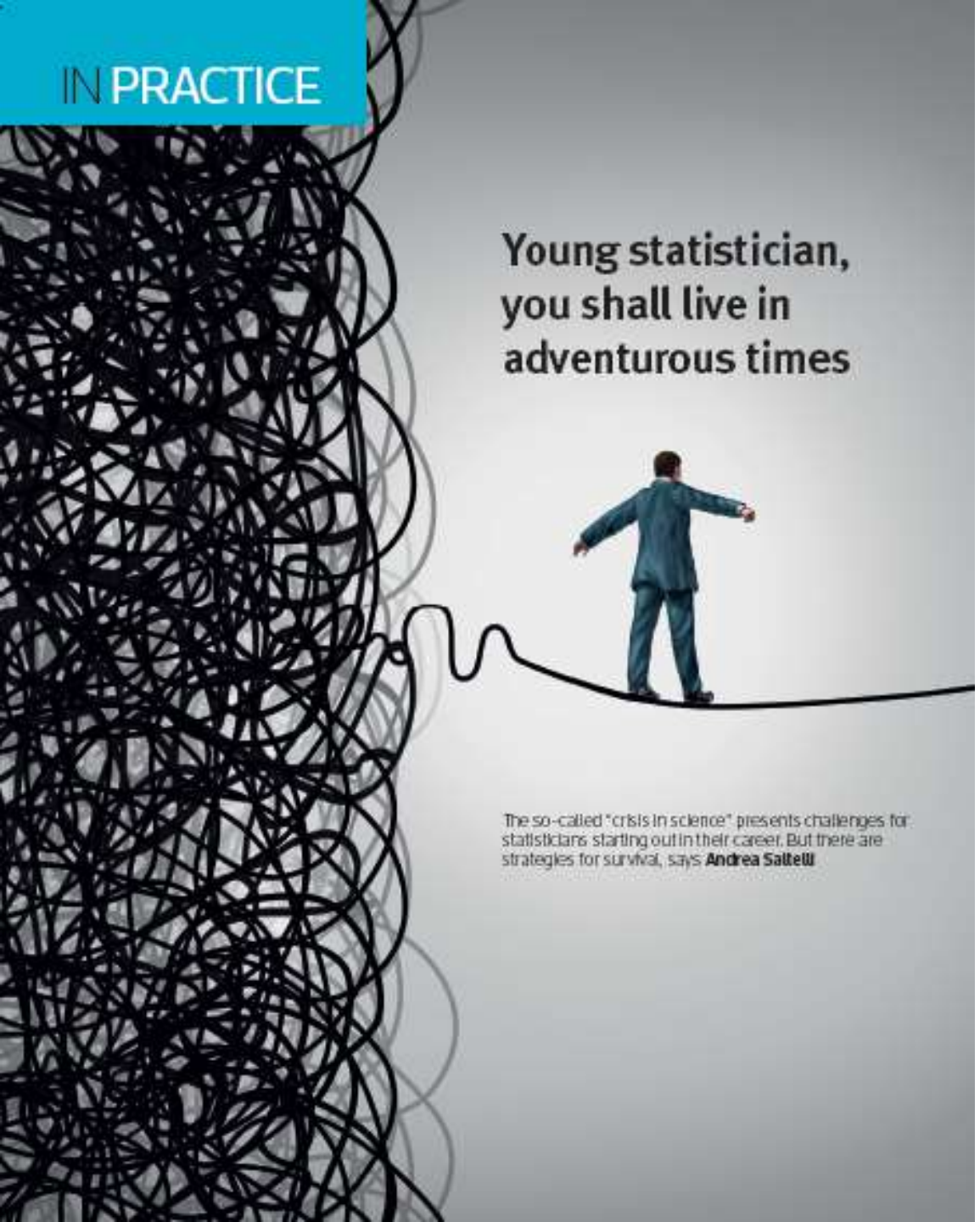
Thomas Kuhn, The structure of scientific revolution, 192, Chapters I and XIII

and “the member of a mature scientific community is, like the typical character of Orwell’s 1984, the victim of a history rewritten by the powers that be.”

Thomas Kuhn, The structure of scientific revolution, 192, Chapter XIII

Thus disciplinary advancements are presented in textbooks as the “perception of the obvious” made by one-eyed men in the kingdom of the blinds (Ravetz, 1971).

Can statisticians ignore their role in Eugenics, can chemists ignore what is phlogiston, or geologists how Alfred Lothar Wegener 1915 theory of Continental Drift was met with skepticism …



SIGNIFICANCE
ROYAL STATISTICAL SOCIETY
ASA AMERICAN STATISTICAL ASSOCIATION

More here

https://rss.onlinelibrary.wiley.com/doi/10.1111/j.1740-9713.2016.00983.x

Why ethics and science cannot be separated?

See a clean version here:
http://www.andreasaltelli.eu/file/repository/Ideological_committment.pdf

How science is conceived has important political implications

The **Vienna Circle** and the fight against the 'metaphysical and theologizing' associated with fascism and national socialism (1929). Modern empiricism as a scientific world conception

Verification or falsification?

Karl Popper

A radical departure from the principle of 'verification' that was at the heart of the Vienna Circle positivism (inductivism)

Verification or falsification?

Karl Popper

Truth cannot be verified: it can only be falsified

RADICAL PHILOSOPHY

issue 037 series 1 Summer 1984

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Ideological Commitments in the Philosophy of Science

With a Comment on Ravetz by Edgley

Jerry Ravetz and Roy Edgley

RP 037 (Summer 1984)

Socratic ethos

Is Socrates saying that he knows the truth?

And what kind of man am I? One of those who would gladly be refuted if anything I say is not true, and would gladly refute another who says what is not true, but would be no less happy to be refuted myself than to refute, for I consider that a greater benefit … I believe there is no worse evil for man than a false opinion about the subject of our present discussion

Courtesy of Kjetil Rommetveit

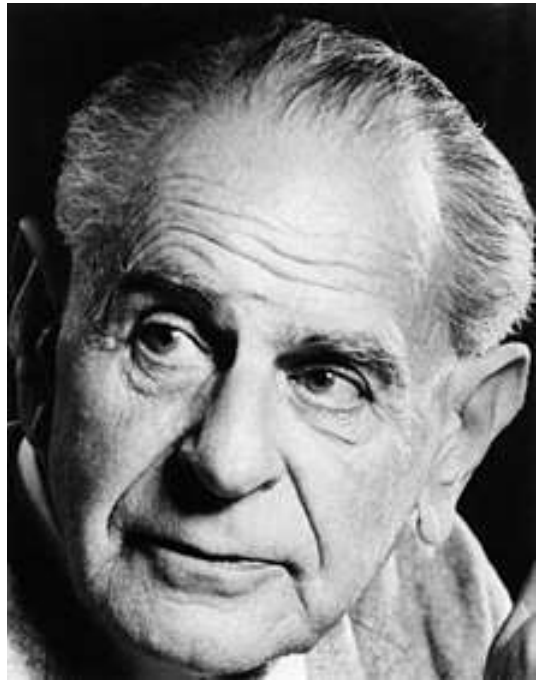
Verification or falsification?

Karl Popper

Demarcation science/non-science ➔ Marxist historiography and psychoanalysis are not science

Verification or falsification?

A champion of liberal democracy at times of cold war; open society as an alternative to totalitarianism



Karl R. Popper
1902–1994

A critical member of the Mont Pelerin society, with Friedrich Hayek, Milton Friedman, Ludwig von Mises and others,

Paradigm shifts

Thomas Kuhn: a disenchanted vision of science as alternating between ‘normal’ and ‘revolutionary’

Puzzle solving, dogmatic science, then a paradigm shift … then the same over again

Lost a direction a progress

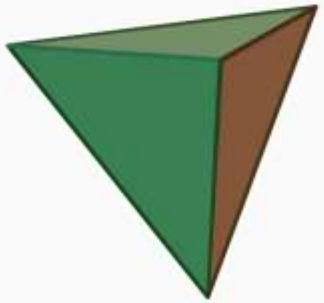
Imre Lakatos: defending science from its enemies. Remedying the weaknesses in Popper's program

"Proofs and Refutations" revealing the ambiguities of proof even in mathematics, on 'Euler Polyhedron Theorem'; If even mathematics can be ambiguous how can science be dogmatic?

Who remembers the theorem?

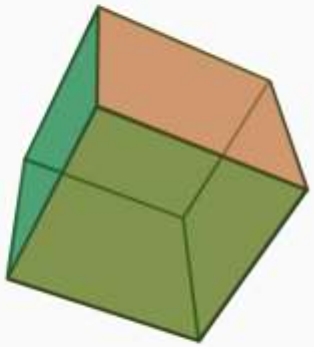
Euler's Polyhedron Formula

Vertices - **E**dges + **F**aces = 2



V = 4 E = 6 F = 4

4 - 6 + 4 = 2

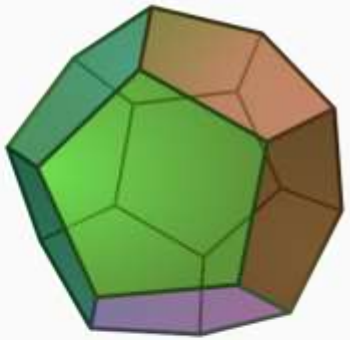


V = 8 E = 12 F = 6

8 - 12 + 6 = 2

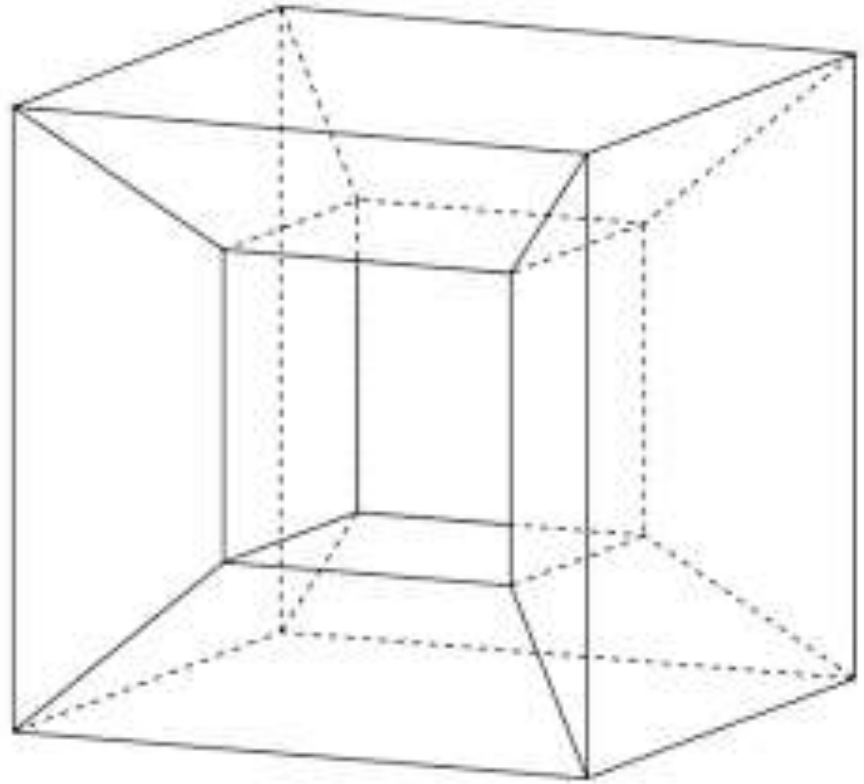
V = 6 E = 12 F = 8

6 - 12 + 8 = 2



V = 20 E = 30 F = 12

20 - 30 + 12 = 2



A monster example?

Imre Lakatos: The idea of ‘decadal’ research programmes to save Popper’s falsificationism from Kuhn’s critique by combining the two visions, abandoning ‘naïve falsificationism’

Paul Feyerabend

Perhaps the most erudite and most philosopher among the four; and the most destructive of any theory of scientific method

In “Against Method” he shows how the best among scientists (e.g. Galileo Galilei) violated any ‘rule’

A court jest, a fascist,
a Zen master? Asks Ravetz

Paul Feyerabend

Human imperfections of Galileo can 'blow the mind' of a student for whom the authority of science is as absolute

After such a shock the student may be ready to awaken to the truth that there is no truth to awaken to (Feyerabend as a Zen master?)


RADICAL PHILOSOPHY

037

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Ideological Commitments in the Philosophy of Science

With a Comment on Ravetz by Edgley

Jerry Ravetz and Roy Edgley

Paul Feyerabend

For Ravetz, Feyerabend shows to the lay public science's sacred images being sprayed by a philosophical machine gun (Feyerabend as a fascist?)

Killing science as we know it or showing the hypocrisy of this image?

Ravetz's conclusions

The edifice built by Popper and Lakatos was vulnerable to the critique of Kuhn and Feyerabend, perhaps because of its ideological aspirations

Yet the Enlightenment battle against the church cultural and political hegemony is over, so is a simplistic image of science upholding the Good and the True

Is this true?

The Enlightenment battle against the church cultural and political hegemony is over, so is a simplistic image of science upholding the Good and the True

The Republic of Science: Its Political and Economic Theory
Michael Polanyi

Science as a market which feeds society's thirst for self improvement

Science as a community of practice capable of self-governance

Michal Polanyi

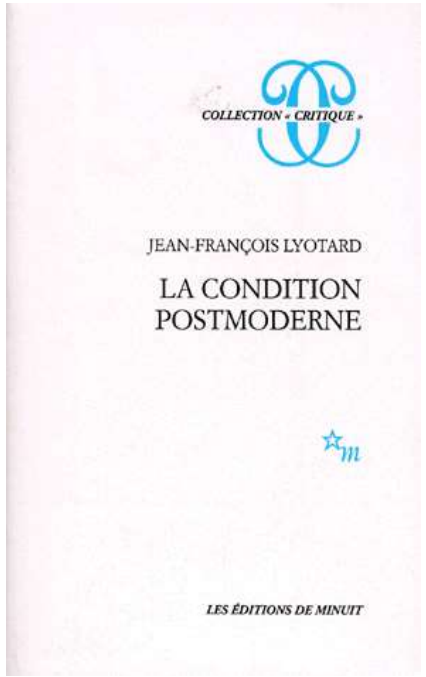
Minerva, I, 1 (Autumn, 1962) , pp. 54- 73, https://mitpress-request.mit.edu/sites/default/files/titles/content/9780262690201_sch_0001.pdf

For Lyotard the grand narrative of the relation between knowledge/science and power has come to an end

Jean-François Lyotard

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

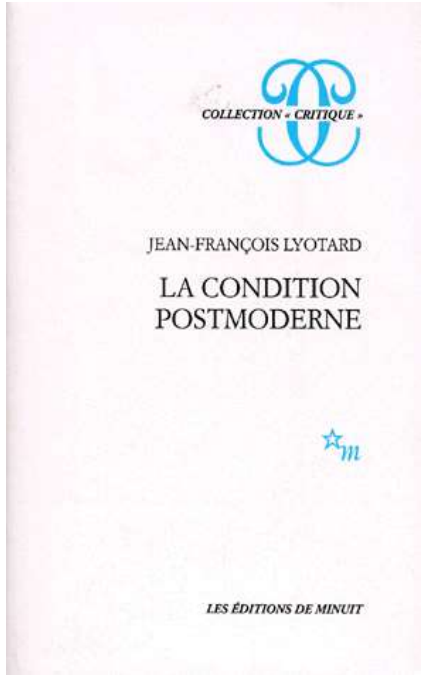
“The question of the legitimacy of science has been indissociably linked to that of the legitimation of the legislator since the time of Plato.”



Jean-François Lyotard

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

“…the right to decide what is true is not independent of the right to decide what is just,[…] there is a strict interlinkage between the kind of language called science and the kind called ethics and politics …”



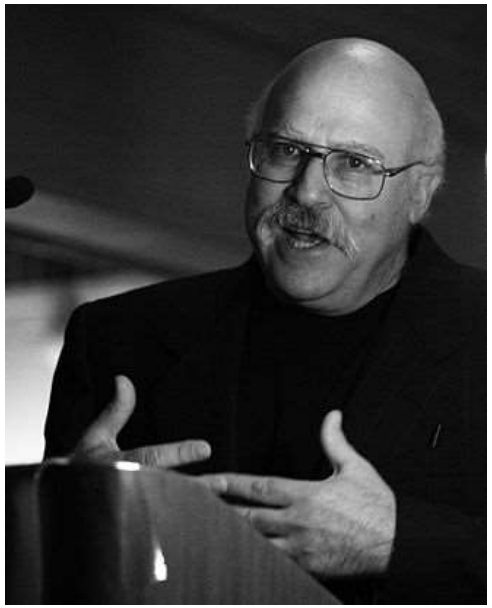
Jean-François Lyotard

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

“Solutions to the problem of knowledge are solutions to the problem of social order…

Trust in Science and trust in the prevailing social order are linked.”

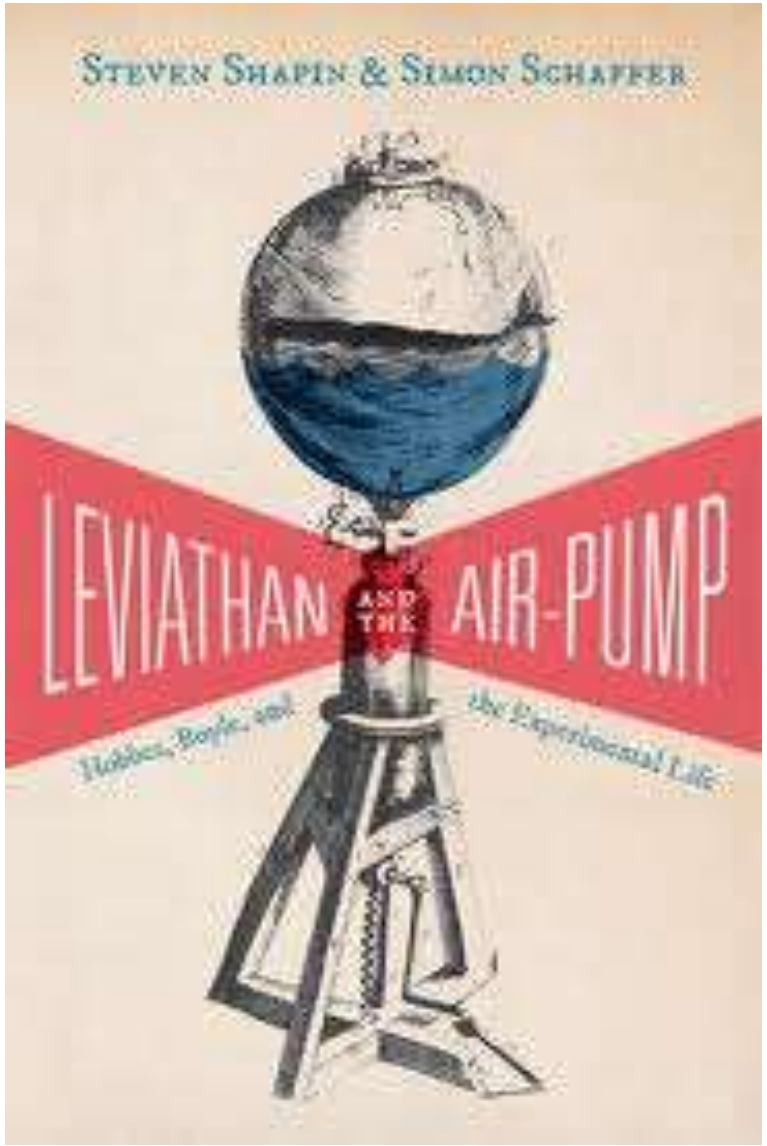
Simon Schaffer



Steven Shapin

Shapin, S., Schaffer, S., 1985, Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life, Princeton, 2011 Edition

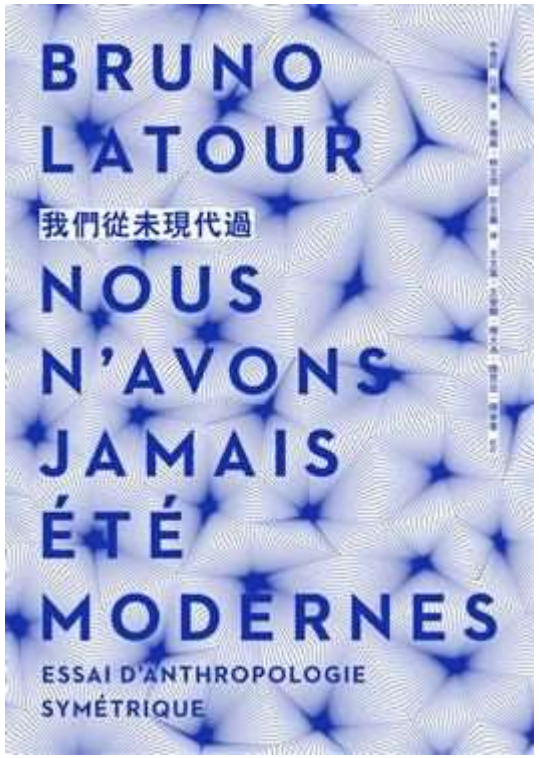
Establishing ‘matter of facts’ under controlled ‘laboratory’ experiments before witnesses as a way to subtract the discourse about knowledge from religious squabbles …



Shapin, S., Schaffer, S., 1985, Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life, Princeton, 2011 Edition

Shapin and Schaffer's book inspired Bruno Latour's 'Nous n'avons jamais été modernes', 1991, and was 'hot' during the 'science wars'.

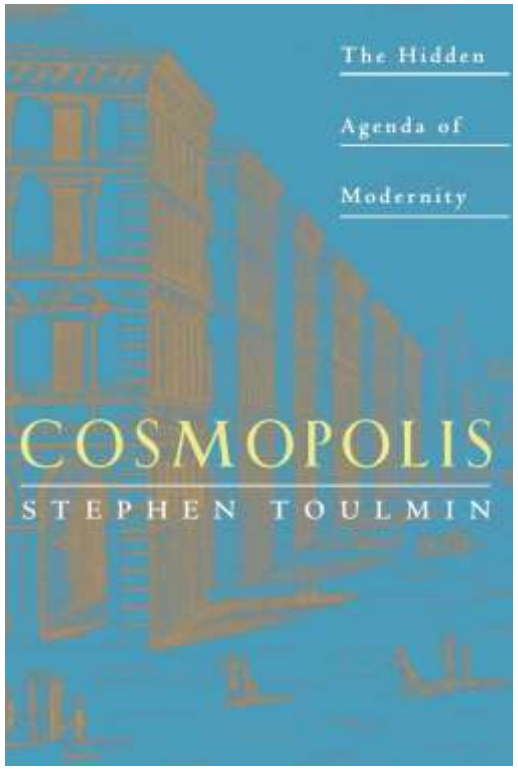
Bruno Latour



Latour, B., 1991, Nous n'avons jamais été modernes, Editions La découverte, 1993; We Have Never Been Modern. Cambridge, Harvard UP.

Stephen Toulmin: Modernity as a counter-Renaissance; Descartes versus Montaigne; the delusion of a Newtonian view of society

Stephen Toulmin



Stephen Toulmin, 1990, Cosmopolis: The Hidden Agenda of Modernity, The University of Chicago Press.

The roots of the Cartesian dream

Francis Bacon
(1561-1626)
Magnalia Naturae, in the New Atlantis (1627), '*Wonders of nature, in particular with respect to human use*'

We call Cartesian dream the idea of man as master and possessor of nature, of prediction and control, of Bacon's wonders of science and of Condorcet's mathematique sociale…

René Descartes
(1596-1650)
Discourse on Method
(1637)

Nicolas de Caritat, marquis de Condorcet
(1743- 1794)
'Sketch for a Historical Picture of the Progress of the Human Spirit'

Francis Bacon
(1561–1626)

Magnalia Naturae, in the New Atlantis (1627),

'Wonders of nature, in particular with respect to human use'

The prolongation of life; The restitution of youth in some degree; The retardation of age; The curing of diseases counted incurable; The mitigation of pain; More easy and less loathsome purgings; The increasing of strength and activity; The increasing of ability to suffer torture or pain; The altering of complexions, and fatness and leanness; The altering of statures; The altering of features; The increasing and exalting of the intellectual parts; Versions of bodies into other bodies; Making of new species; Transplanting of one species into another; Instruments of destruction, as of war and poison; Exhilaration of the spirits, and putting them in good disposition; Force of the imagination, either upon another body, or upon the body itself; Acceleration of time in maturations; Acceleration of time in clarifications; Acceleration of putrefaction; Acceleration of decoction; Acceleration of germination; Making rich composts for the earth; Impressions of the air, and raising of tempests; Great alteration; as in induration, emollition, &c; Turning crude and watery substances into oily and unctuous substances; Drawing of new foods out of substances not now in use; Making new threads for apparel ; and new stuffs, such as paper, glass, &c; Natural divinations; Deceptions of the senses; Greater pleasures of the senses; Artificial minerals and cements.

Magnalia Naturae, in the New Atlantis (1627),

'Wonders of nature, in particular with respect to human use'

Francis Bacon (1561-1626)

The prolongation of life; The restitution of youth in some degree; The retardation of age; The curing of diseases counted incurable; The mitigation of pain;
[…]
Drawing of new foods out of substances not now in use; Making new threads for apparel; and new stuffs, such as paper, glass, etc.; Natural divinations; Deceptions of the senses; Greater pleasures of the senses; Artificial minerals and cements.

The study of letters leading to “doubts and errors”;

Comparing “disquisitions of the ancient moralists to very towering and magnificent palaces with no better foundation than sand and mud”;

Condemnation of humanities and exaltation of mathematics.

René Descartes (1596–1650)

Discourse on Method (1637)

“I perceived it to be possible to arrive at knowledge highly useful in life; and in room of the Speculative Philosophy […], to discover a Practical, by means of which, knowing the force and action of fire, water, air, the stars, the heavens, and all the other bodies that surround us, […]we might also apply them […], and thus render ourselves the lords and possessors of nature.”

http://www.bartleby.com/34/1/6.html

René Descartes (1596-1650)

Discourse on Method (1637)

In the formulation of Condorcet: “All the errors in politics and in morals are founded upon philosophical mistakes, which, themselves, are connected with physical errors” (Ninth Epoch)

Nicolas de Caritat, marquis de Condorcet
(1743- 1794)

‘Sketch for a Historical Picture of the Progress of the Human Spirit’

http://oll.libertyfund.org/titles/1669

Overpopulation? War due to scarcity of resources? Will not happen because technical progress and ethical progress will go hand in hand. Man will understand that his duty “will consist not in the question of giving existence to a greater number of beings, but happiness.” (Tenth Epoch)

Nicolas de Caritat, marquis de Condorcet
(1743- 1794)
‘Sketch for a Historical Picture of the Progress of the Human Spirit’

http://oll.libertyfund.org/titles/1669

‘Mathématique sociale’: We still use today terms such as ‘Condorcet method’, ‘Condorcet winner’, ‘Condorcet-ranking procedure’

Nicolas de Caritat,
marquis de Condorcet
(1743- 1794)

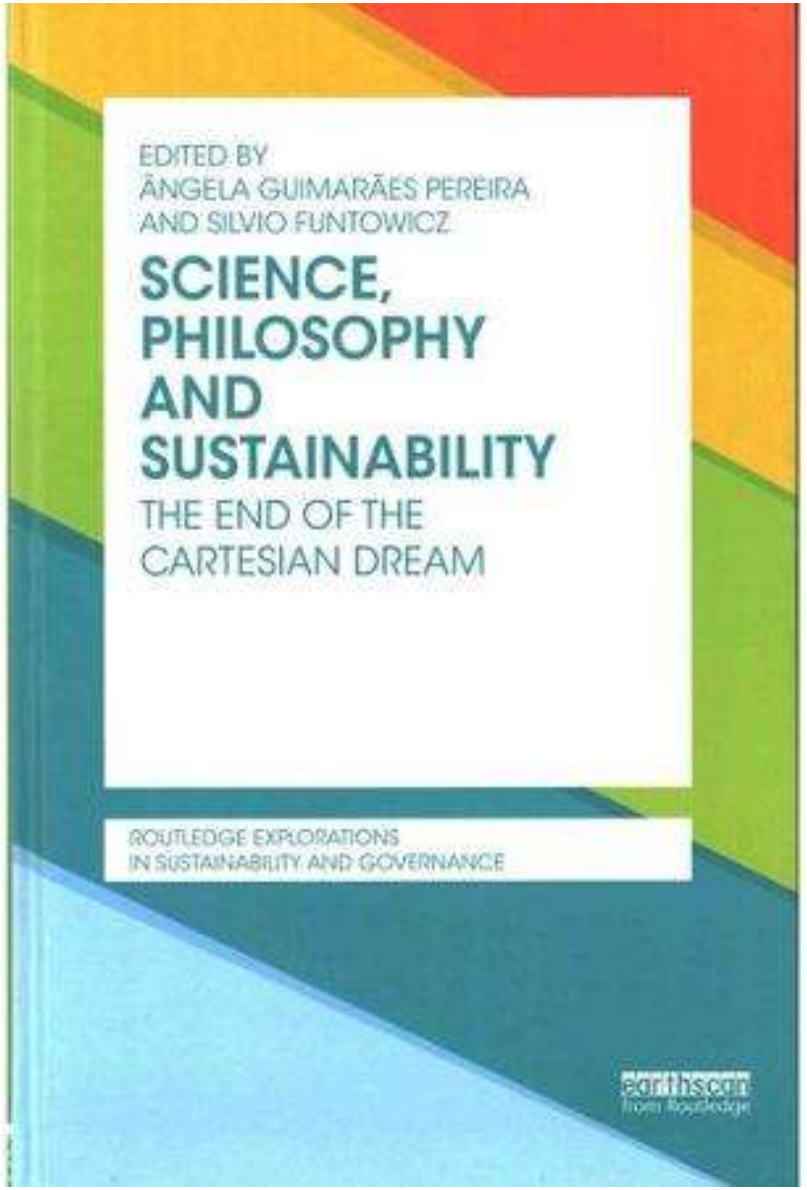
‘

Feldman, J., 2005, Condorcet et la mathematique sociale: enthousiasmes et bemols, Mathematics and Social Sciences, 172(4), 7-41, http://www.ehess.fr/revue-msh/pdf/N172R955.pdf

Munda G. (2007) - Social multi-criteria evaluation, Springer-Verlag, Heidelberg, New York, Economics Series

Condorcet's algorithms and Descartes' Geometry: the dream always had a quantification agenda

Some reading on the Cartesian Dream



Ravetz, J., R., 2015, Descartes and the rediscovery of ignorance, in Guimarães Pereira, Â., and Funtowicz, S., Eds., 2015, The end of the Cartesian dream, Routledge.

Closer to our times the dream was couched in the ‘Endless Frontier’ metaphor by Vannevar Bush, 1945:

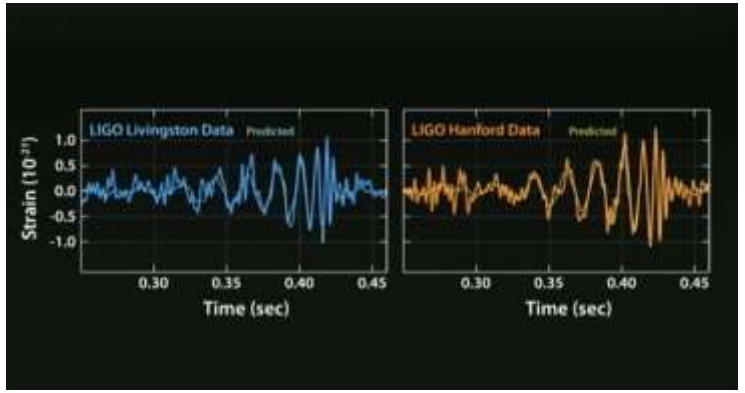
Vannevar Bush
(1890–1974)

“One of our hopes is that after the war there will be full employment. […] To create more jobs we must make new and better and cheaper products […] founded on […] basic scientific research. […the] Government […] opened the seas to clipper ships and furnished land for pioneers. Although these frontiers have more or less disappeared, the frontier of science remains.”

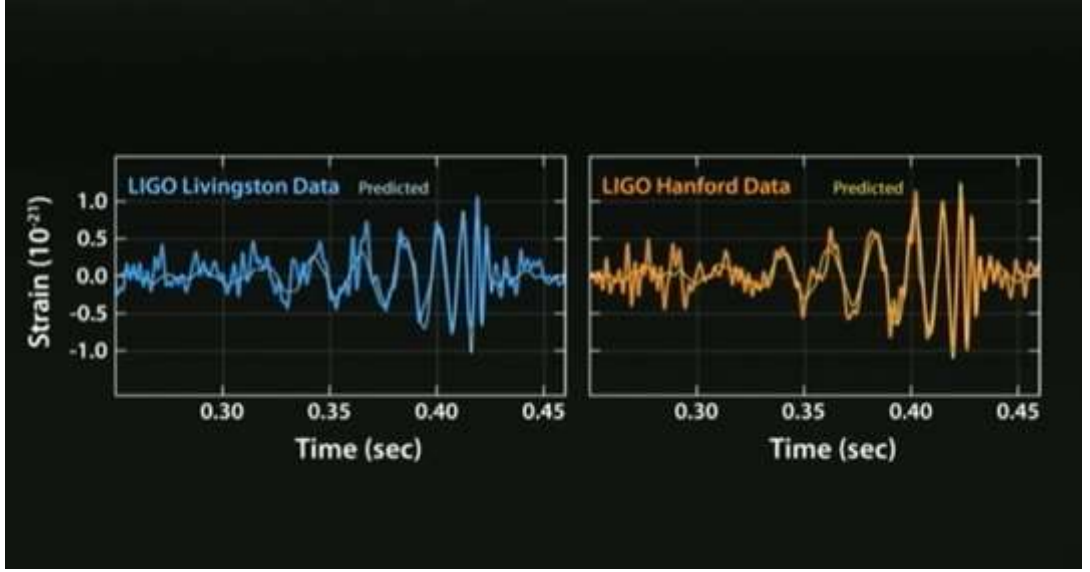
Bush, V. (1945) Science: the endless frontier, United States Office of Scientific Research and Development, U.S. Govt. print office.

The success of the Cartesian dream

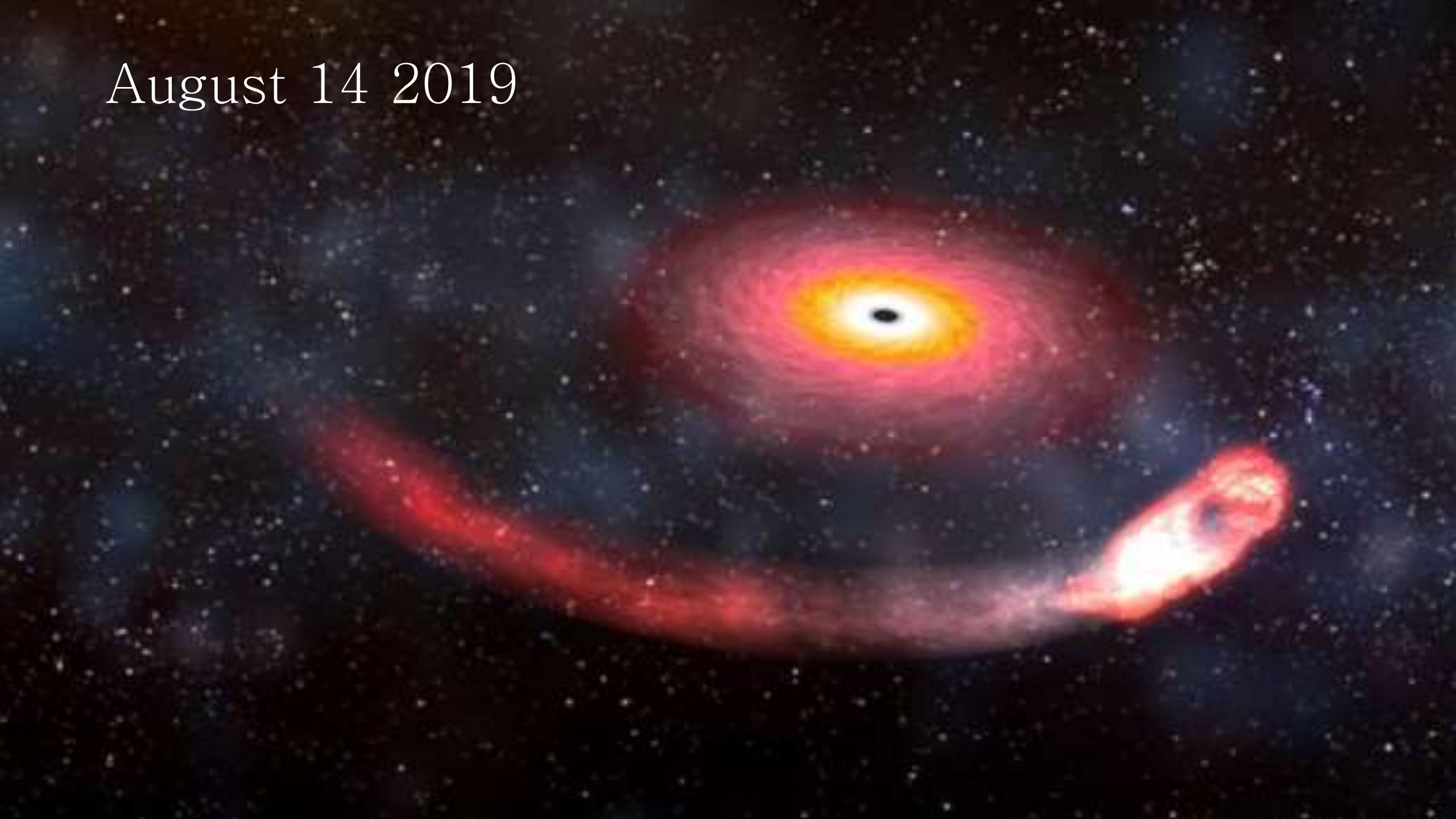
The keeping of the promise: Gravitational waves, from J. Weber's cylinder to LIGO



A Madman Dreams of Tuning Machines: The Story of Joseph Weber, the Tragic Hero of Science Who Followed Einstein's Vision and Pioneered the Sound of Space-Time, By Maria Popova, https://www.brainpickings.org/2016/04/25/black-hole-blues-janna-levin-joseph-weber/



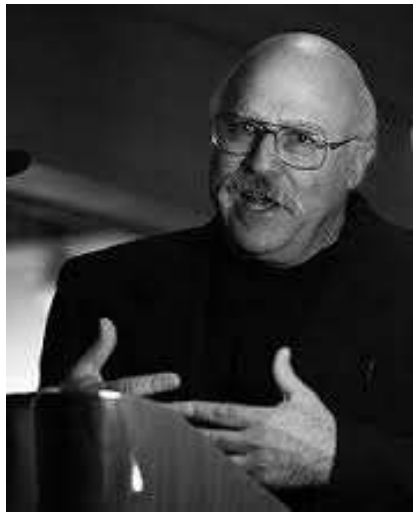
https://www.brainpickings.org/2016/04/25/black-hole-blues-janna-levin-joseph-weber/


August 14 2019

If you are a natural scientists you were nourished and trained in the Cartesian dream (S. Toulmin: ‘The hidden agenda of modernity’)

Stephen Toulmin

The dream was spectacularly successful, in all fields of endeavor, leading to what Steven Shapin calls ‘invisible science’



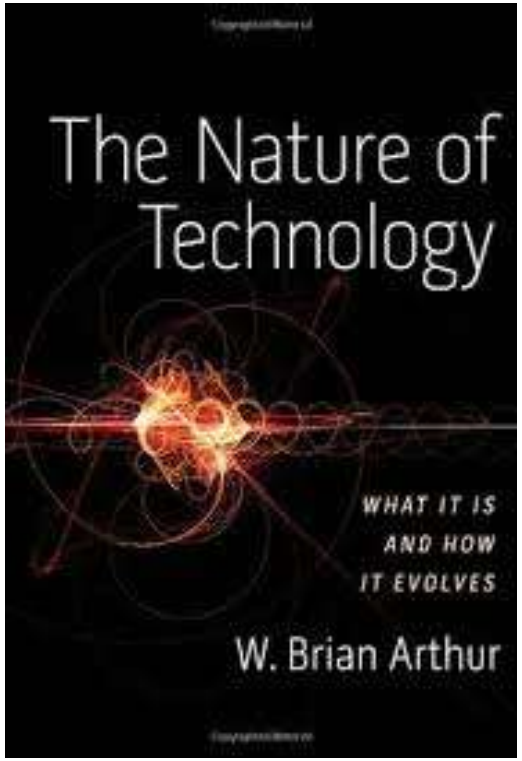
Steven Shapin

Steven Shapin, 2016, Invisible Science, The Hedgehog Review: Vol. 18 No. 3 (Fall 2016)
W.B. Arthur, The nature of technology, Free Press, New York, 2009.

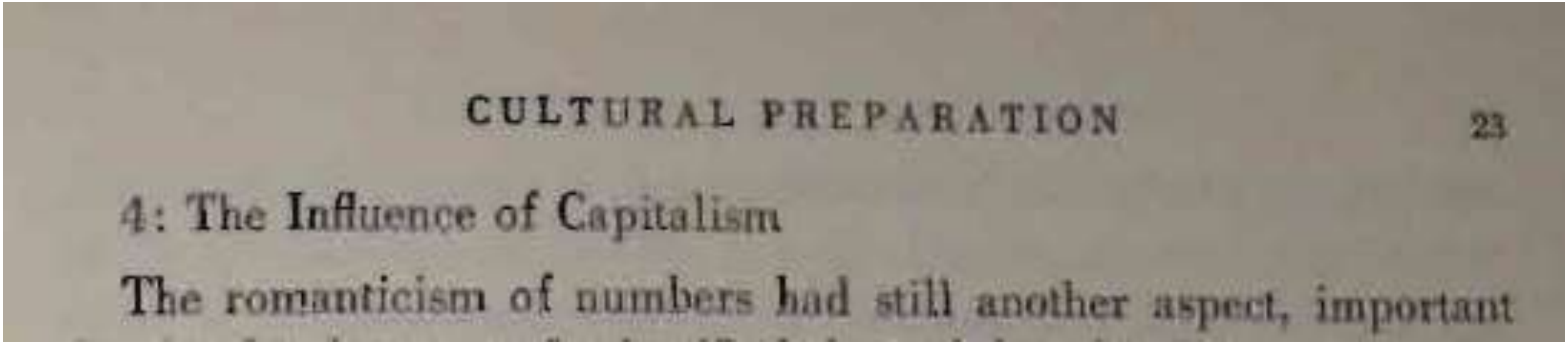
The critique of the Cartesian dream

What do Lyotard, Toulmin, Dewey, Bakunin, and (Fritz) Schumacher have in common?

From post-modern thinkers to pragmatists to anarchists to the fathers of the ecological movement, a common concern about mastering science and technology and its uses, about the dangers of modernity



Lewis Mumford explained in 1934 how well the ‘machine’ integrates with capitalism



CULTURAL PREPARATION 23

4: The Influence of Capitalism

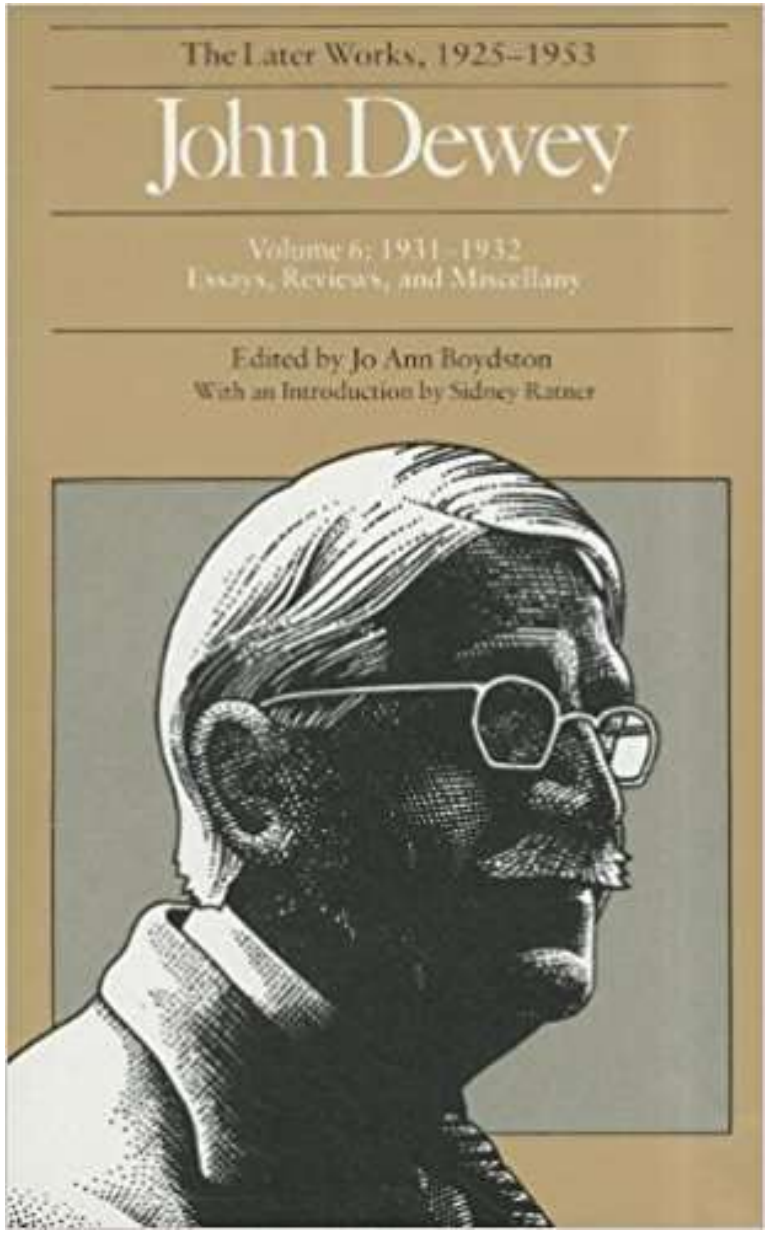
The romanticism of numbers had still another aspect, important

Lewis Mumford, **1934**, Techniques and Civilization, ROUTLEDGE & KEGAN PAUL LTD, p. 23-31 of the 1955 edition.

From pragmatists to anarchists (Peter Kropotkin, Mikhail Bakunin), from the fathers of the ecological movement to post-modern thinkers: a common concern about mastering science and technology

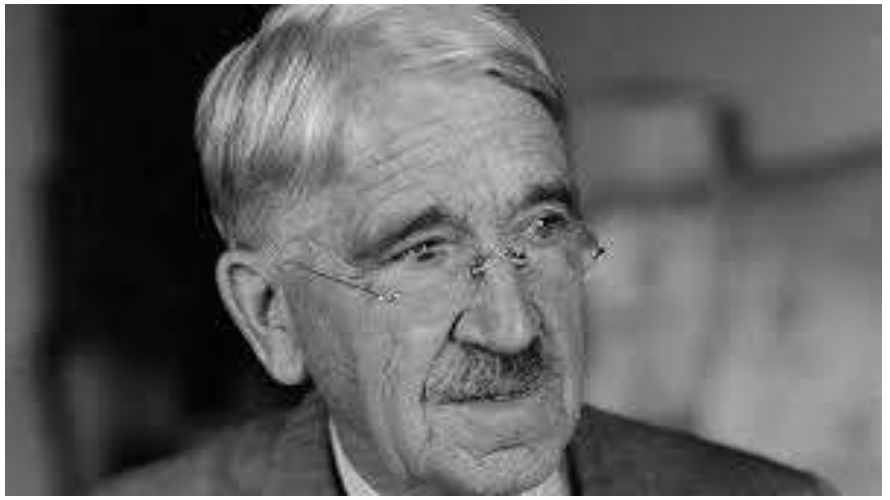
Here lies the heart of our present social problem. Science has hardly been used to modify men's fundamental acts and attitudes in social matters. It has been used to extend enormously the scope and power of interests and values which anteceded its rise. Here is the contradiction in our civilization. The potentiality of science as the most powerful instrument of control which has ever existed puts to mankind its one outstanding present challenge.

From J. Dewey 'Science and Society' in John Dewey: The Later Works, 1925-1953: 1931-1932, Vol. 6-ExLibrary



John Dewey 1859-1952

“Here lies the contradiction of our civilization. The potentiality of science as the most powerful instrument of control which has ever existed puts to mankind its one outstanding present challenge”



John Dewey

J. Dewey, Science and society, in ‘John Dewey: The Later work , 1931-1932 Vol. 6

"Science, which should have been the wind of truth to clear the air, has polluted the air, helped to brainwash, and provided weapons for war."

Paul Goodman

Now resurgent concern for military/authoritarian apps

Paul Goodman, 1970, New Reformation, Notes of a Neolithic Conservative, PM press (2010 Edition).

Techies' fury at being drafted for Trump army

Working for the Pentagon is prompting staff revolts in Silicon Valley

Danny Fortson, San Francisco

November 4 2018, 12:01am, The Sunday Times

"From Amazon to Google, rank-and-file employees are revolting against their employers for taking the powerful tools they helped to build and selling them for unexpected purposes, from apprehending illegal immigrants to supercharging America's war machine"

Doubts about the scientific quantification of the impact of new technologies

Fritz Schumacher

Langdon Winner

E. F. Schumacher, 1973, Small Is Beautiful. Economics as if People Mattered, Penguin Perennial.

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.

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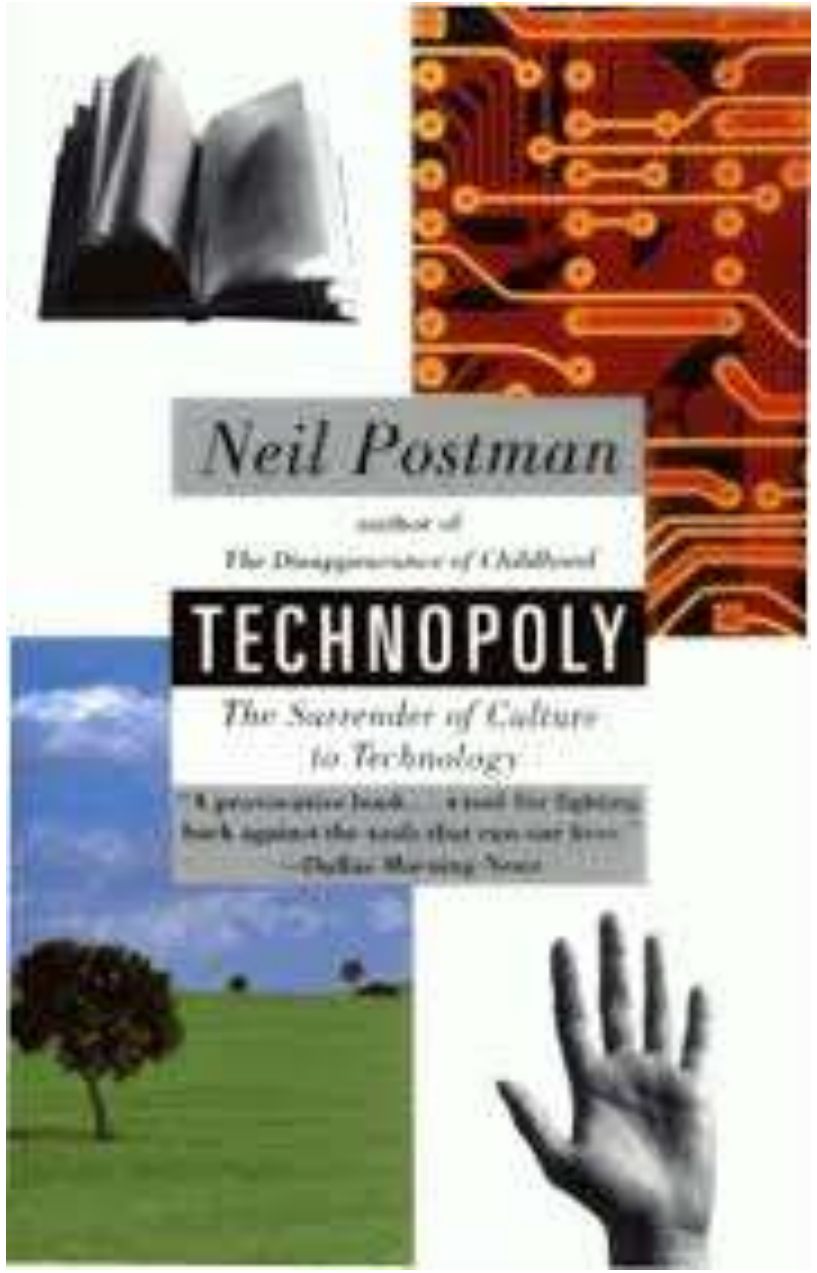
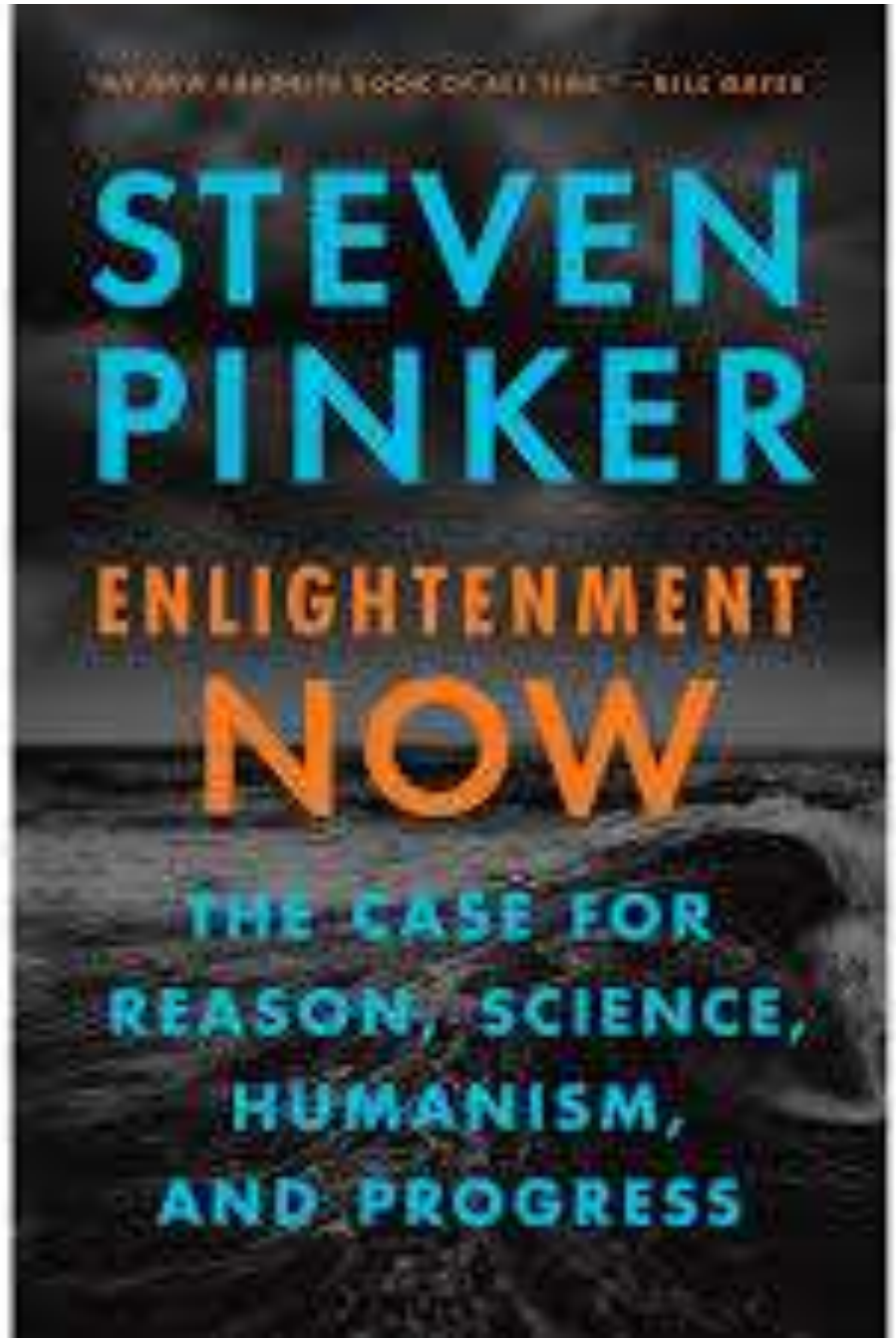
“… it is inescapable that every culture must negotiate with technology, whether it does so intelligently or not"
(N. Postman, Technopoly)

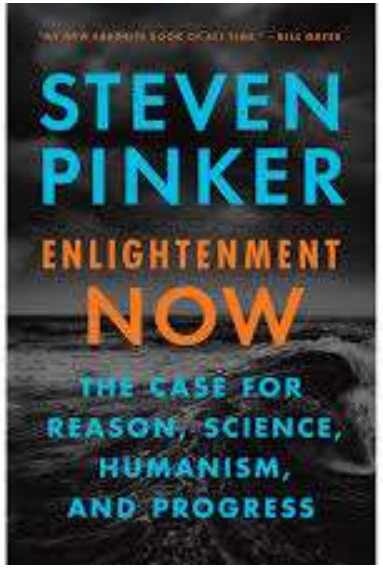


The discussion on the legacy of Enlightenment goes on



Steven Pinker

Jeremy Lent



"A future perfect. Steven Pinker's case for optimism; "Enlightenment Now" explains why the doom-mongers are wrong", The Economist

"Steven Pinker Wants You to Know Humanity Is Doing Fine. Just Don't Ask About Individual Humans" (Jennifer Szalai, The New York Times)

"a monumental apologia for a currently fashionable version of Enlightenment thinking" ((John Gray, New Stateman)

The history of western history's two powerful metaphors: "man as master and possessor of nature" and "nature as a machine"

From the dualism of Greek and Christian philosophies to our days

Contrasted with alternative metaphors, such as nature as a system of systems

The ethos of science

Robert K. Merton, sociologist of science, considered the father of Science and Technology Studies, 1910-2003

CUDOS

Communalism – the common ownership of scientific discoveries, according to which scientists give up intellectual property rights in exchange for recognition and esteem …

Universalism – according to which claims to truth are evaluated in terms of universal or impersonal criteria, and not on the basis of race, class, gender, religion, or nationality;

CUDOS

Disinterestedness – according to which scientists are rewarded for acting in ways that outwardly appear to be selfless;

Organized Scepticism – all ideas must be tested and are subject to rigorous, structured community scrutiny

The same R.K. Merton realized later in life that norms have corresponding counter norms

Mitroff, I. I. 1974, Norms and Counter-Norms in a Select Group of the Apollo Moon Scientists: A Case Study of the Ambivalence of Scientists, American Sociological Review, 39, 579-595.

NORMS AND COUNTER-NORMS IN A SELECT GROUP OF THE APOLLO MOON SCIENTISTS: A CASE STUDY OF THE AMBIVALENCE OF SCIENTISTS*

IAN I. MITROFF

American Sociological Review 1974, Vol. 39 (August): 579-595

This paper describes a three and a half year study conducted over the course of the Apollo lunar missions with forty-two of the most prestigious scientists who studied the lunar rocks. The paper supports the Merton-E. Barber concept of sociological ambivalence, that social institutions reflect potentially conflicting sets of norms. The paper offers a set of counter-norms for science, arguing that if the norm of universalism is rooted in the impersonal character of science, an opposing counter-norm is rooted in the personal character of science. The paper also argues that not only is sociological ambivalence a characteristic of science, but it seems necessary for the existence and ultimate rationality of science.

Three-and-a-half-year study conducted over the course of the Apollo lunar missions with forty-two of the most prestigious scientists who studied the lunar rocks

The paper supports the Merton-E. Barber concept of **sociological ambivalence, that social institutions reflect potentially conflicting sets of norms**

[We must] consider, first, how potentially contradictory norms develop in every social institution; next, how in the institution of science conflicting norms generate marked ambivalence in the lives of scientists; and finally, how this ambivalence affects the actual, as distinct from the supposed, relations between men of science (Merton, 1963a:80).

- Solitariness (secrecy, miserism) is often used to keep findings secret in order to be able to claim patent rights…

Instead of Communalism

- Particularism […] a real issue, particularly when you consider the ratio of researchers in rich countries compared with those in poor countries

Instead of Universalism

- Interestedness arises because scientists have genuine interests at stake in the reception of their research…

Instead of Disinterestedness

- Dogmatism because careers are built upon a particular premise (theory) being true…

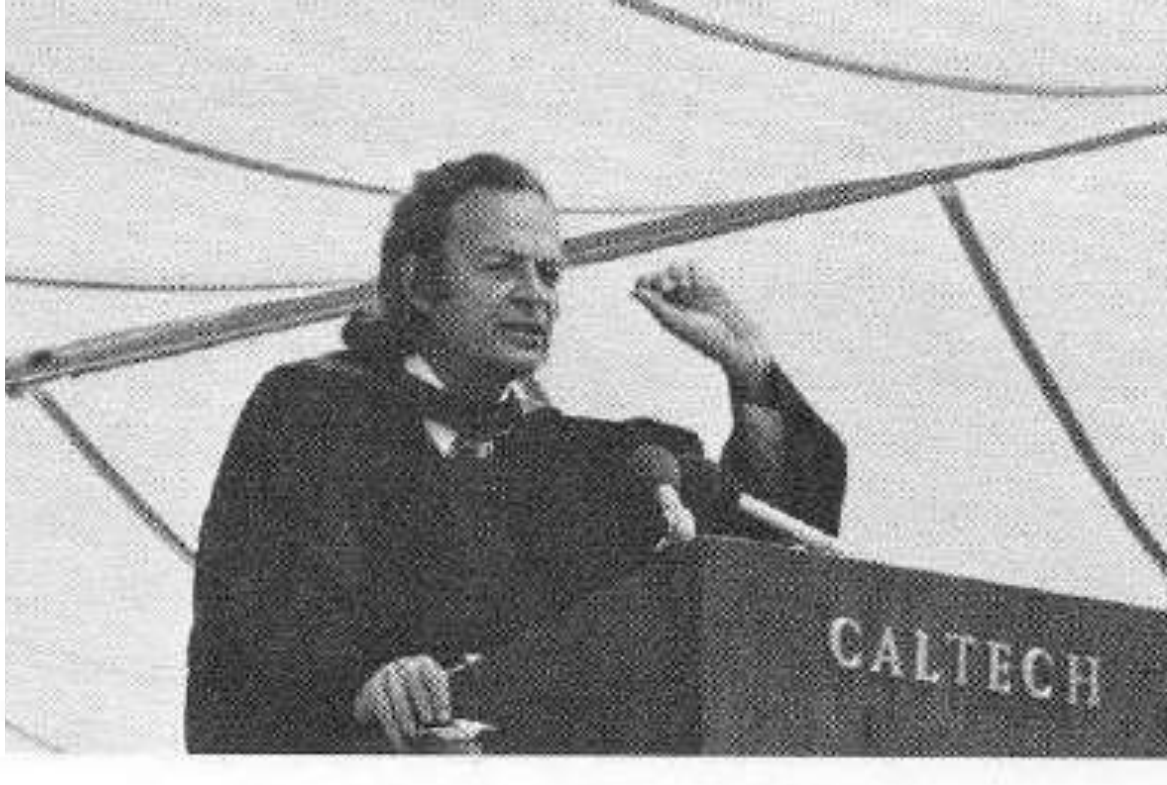
Instead of Organized Skepticism

A lesson from a recent past

Cargo Cult Science

by RICHARD P. FEYNMAN

Some remarks on science, pseudoscience, and learning how to not fool yourself. Caltech's 1974 commencement address.



http://calteches.library.caltech.edu/3043/1/CargoCult.pdf

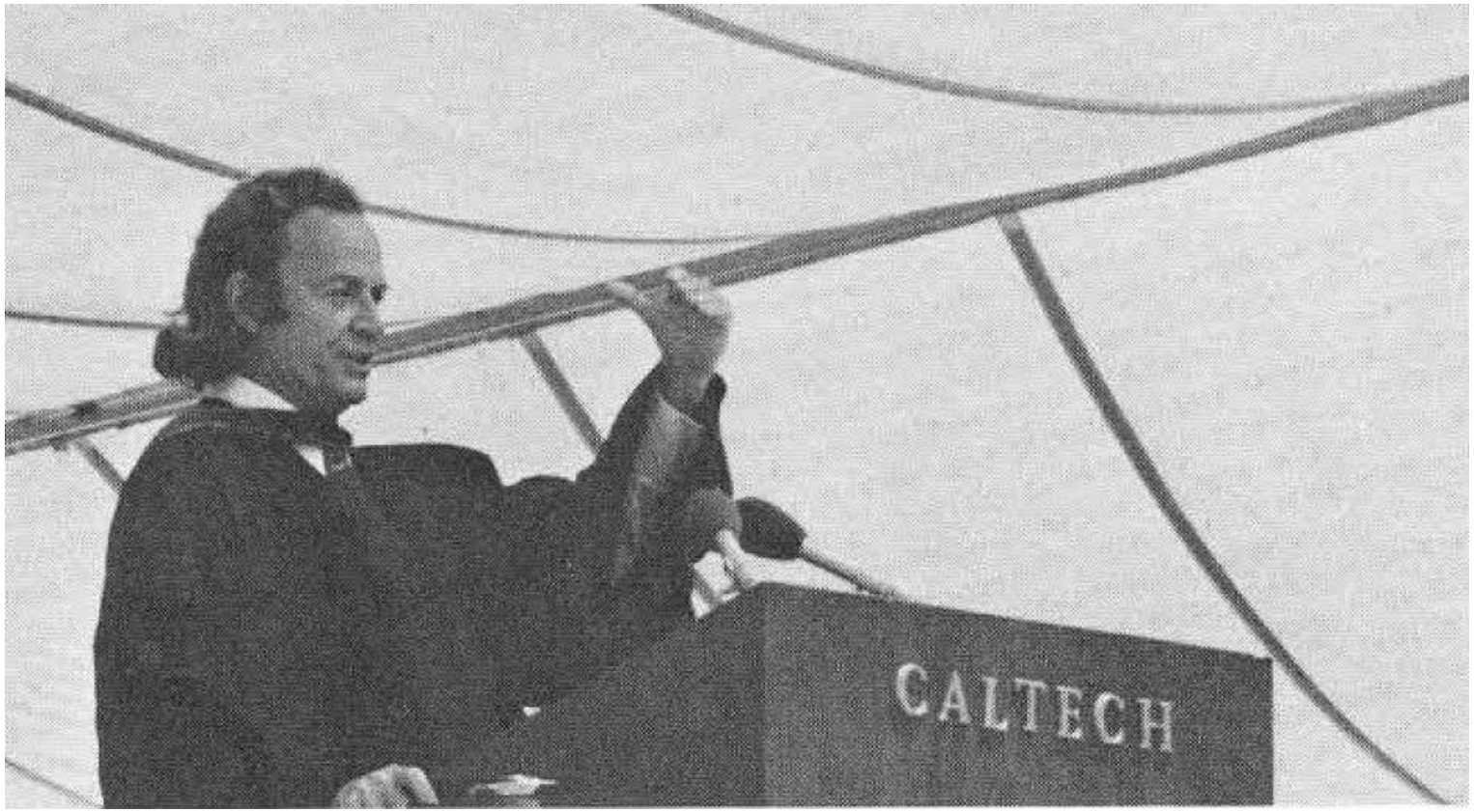
“In the South Seas there is a cargo cult of people. During the war they saw airplanes land with lots of good materials, and they want the same thing to happen now.

So they've arranged to imitate things like runways, to put fires along the sides of the runways, to make a wooden hut for a man to sit in, with two wooden pieces on his head like headphones and bars of bamboo sticking out like antennas—he's the controller—and they wait for the airplanes to land”

“They're doing everything right. The form is perfect. It looks exactly the way it looked before. But it doesn't work. No airplanes land. So I call these things cargo cult science, because they follow all the apparent precepts and forms of scientific investigation, but they're missing something essential, because the planes don't land”

“[…] there is one feature I notice that is generally missing in cargo cult science. That is the idea that we all hope you have learned in studying science in school […] .

It's a kind of scientific integrity, a principle of scientific thought that corresponds to a kind of utter honesty--a kind of leaning over backwards.



“Details that could throw doubt on your interpretation must be given, if you know them. […] give all of the information to help others to judge the value of your contribution.”

The End

@andreasaltelli