

Some elements from history and philosophy of science for nanoethics



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Course NANO 310, August 2021

Where to find this talk: www.andreasaltelli.eu

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CAETERIS ARE
NEVER PARIBUS

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... and these are 6 m worth watching from Slavoj
Žižek [youtube.com/watch?v=TVwKjG...](https://www.youtube.com/watch?v=TVwKjG...)

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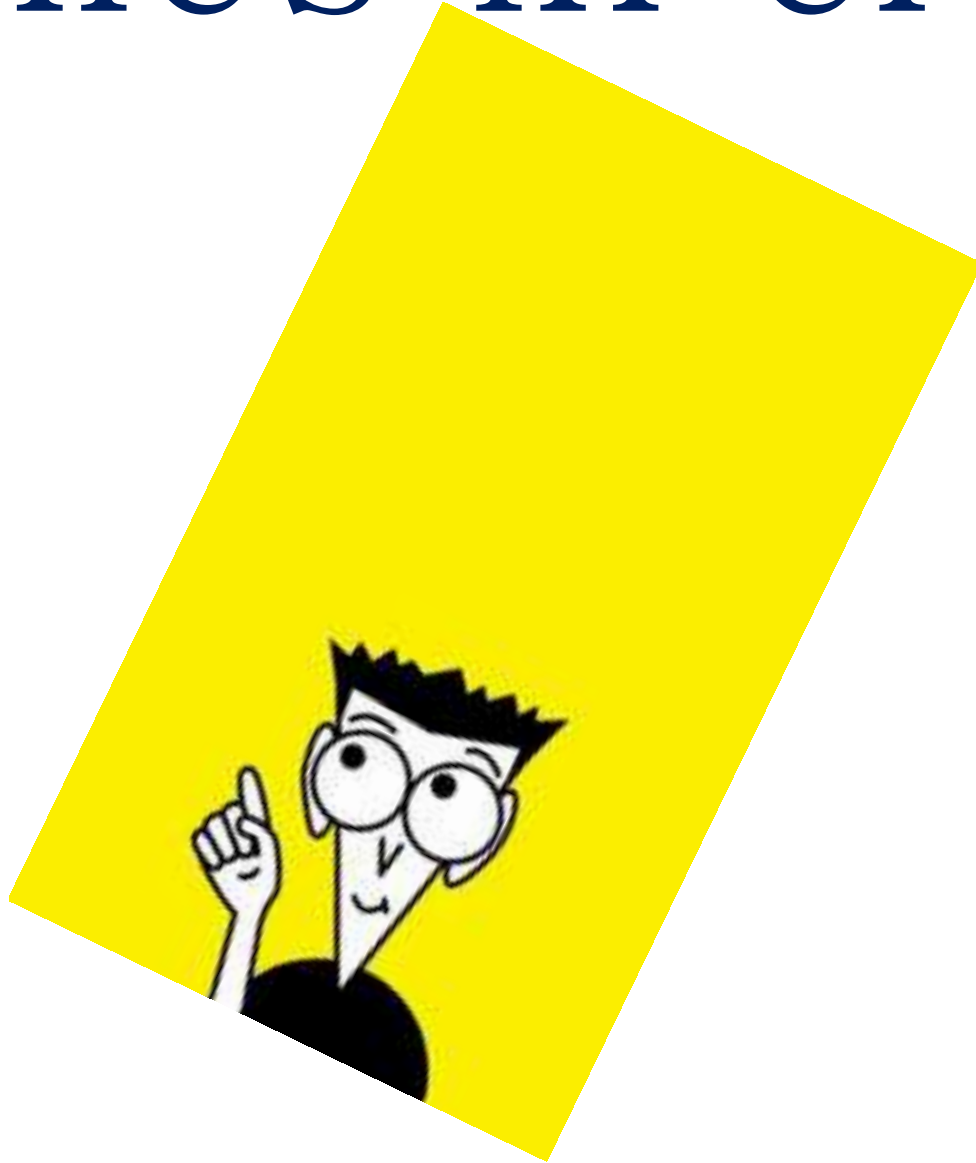
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Ethics in crumbs



Philosophical quests:

Ontology: what is

Epistemology: how to know

Ethics: what to do

Question:
which
comes
first?



Golden rule

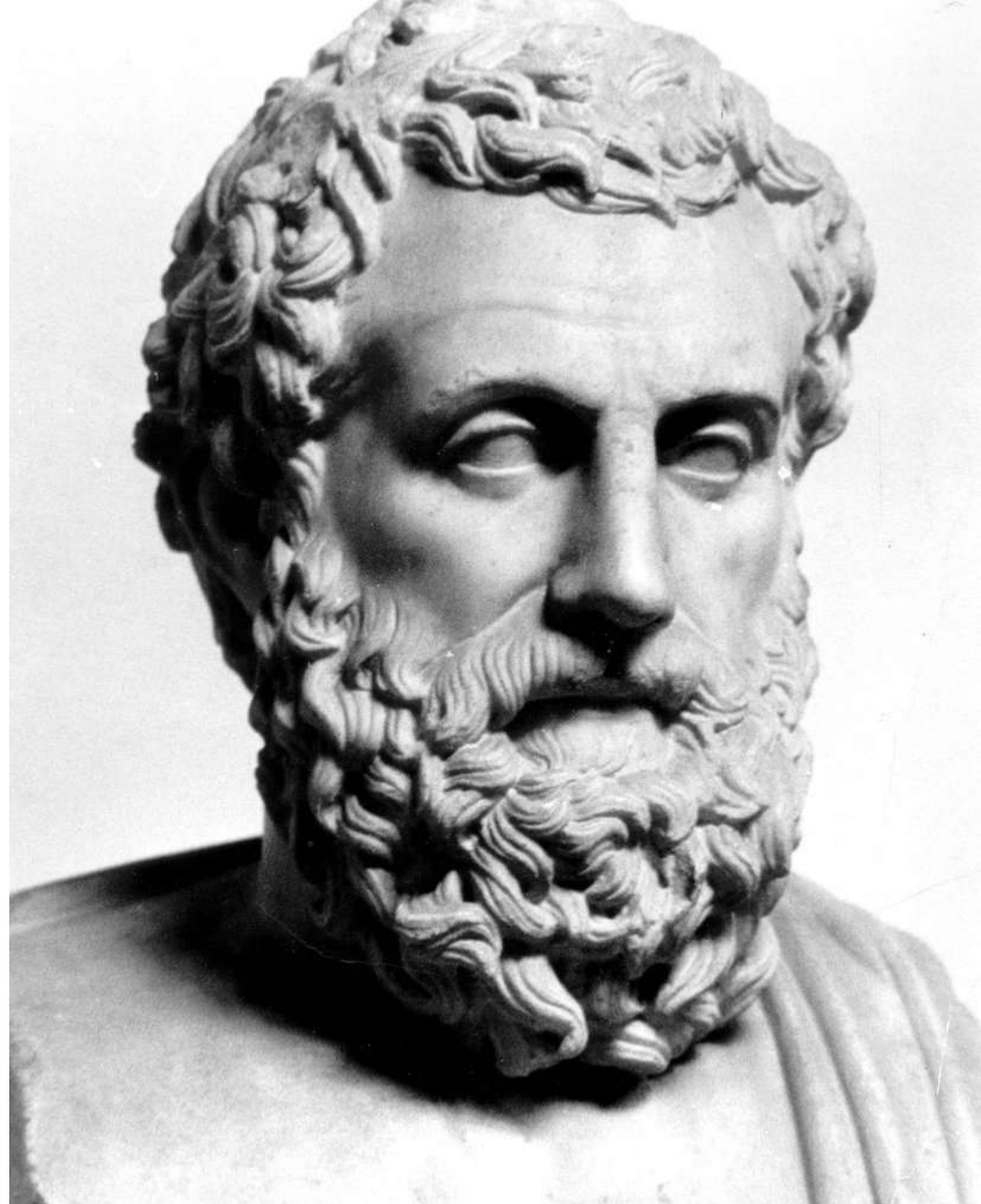
“treat others as you treat yourself” (Mahābhārata, ~IX–V century BCE)

“Avoid doing what you would blame others for doing” (Thales ~624 BC, ~546 BC)

“Treat your inferior as you would wish your superior to treat you” (Seneca, ~4 BC, 65 AD)

“Thou shalt love thy neighbour as thyself”, (Paul the apostle, ~5, ~64 AD)

Aristotle's Nicomachean Ethics



For Aristotle (384, 322 BC) strict relation between ethics and politics

Ethics: How to live a good life (myself)

Politics: How to promote a good life (in the polis)

“...though it is worth while to attain the end merely for one man, it is finer and more godlike to attain it for a nation or for city-states. These, then, are the ends at which our inquiry aims, since it is political science, in one sense of that term”, Book 1, Chapter 2

Ethics for educated citizens [Athenians], no children, no barbaroi, no slaves or craftsmen, no idiots, no women, [but their happiness important]

Unlike in Plato, there is no universal good (no summum bonum)

As the function of man is intellectual activity, his 'good' must be plural and coincide with the exercise of virtues (aretes), among which justice is key

Question: which are the other three virtues?



Happiness descends from the living of a good life;
eudaimonia corresponds to being good to the polis
(ethics and politics together here)

εὐδαιμονία

The concept of eudaimonia has lost little of its appeal; see e.g. Jeffrey Sachs and the World Happiness Report...

Figure 2.7: Ranking of Happiness 2016-2018 (Part 1)

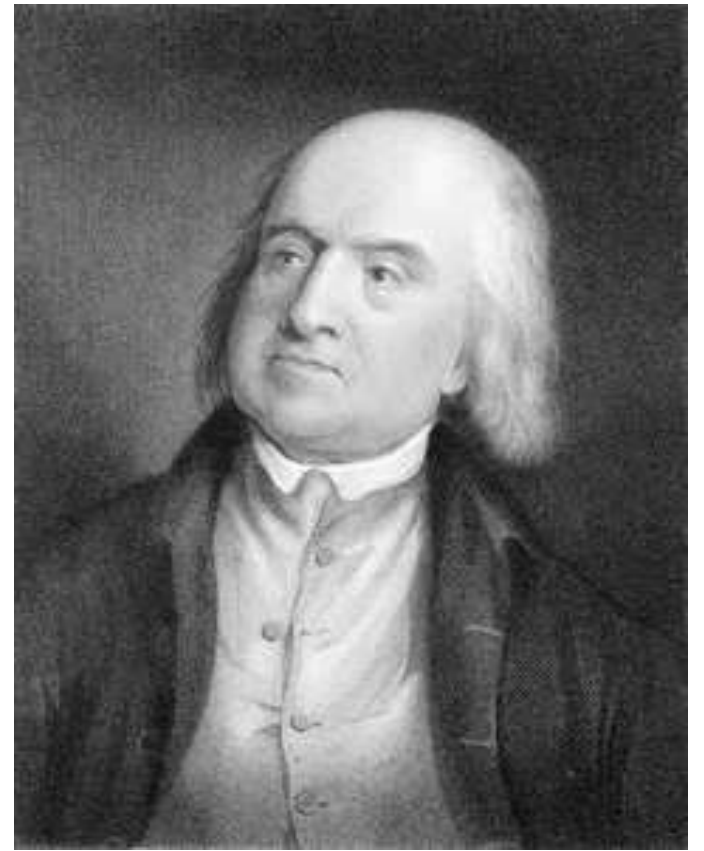


εὐδαιμονία

Fast forward some 22 centuries

Jeremy Bentham's fundamental
axiom

"it is the **greatest** happiness of the
greatest number that is the
measure of right and wrong"



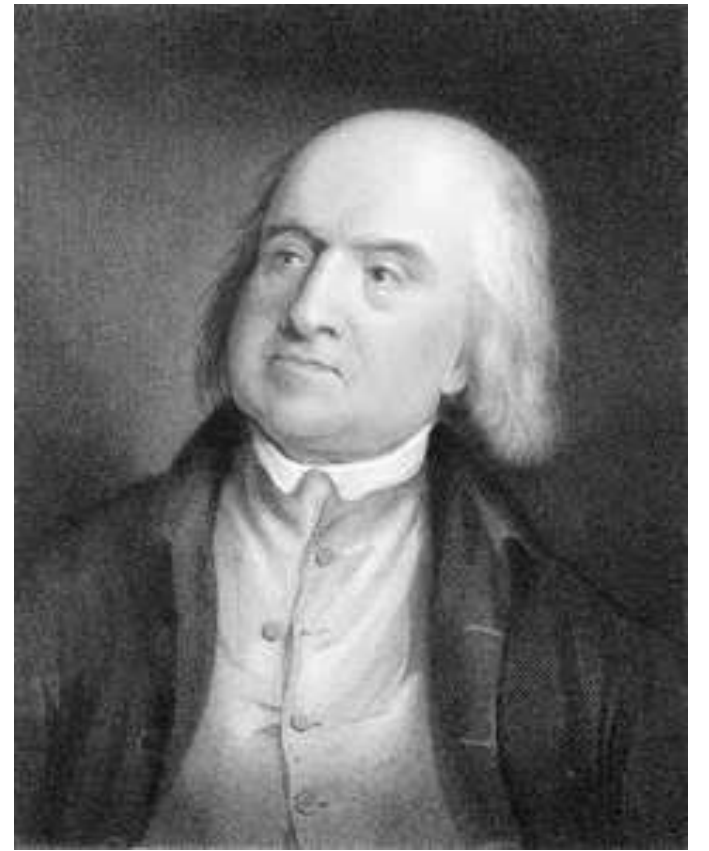
Jeremy Bentham
(1748, 1832)

The long lasting influence of
utilitarianism, e.g. today in economics;

Implies computing the greatest
happiness for the greatest numbers

From Condorcet's *mathématique sociale*
to today's cost benefit analyses

(decisionism, procedural utopia,...)



Jeremy Bentham
(1748, 1832)



SANTA CLARA UNIVERSITY
THE JESUIT UNIVERSITY IN SILICON VALLEY

Andrew Chen, 2002, The Ethics of Nanotechnology,
Markkula Center for Applied Ethics, May 3, 2002,

<https://www.scu.edu/ethics/focus-areas/technology-ethics/resources/the-ethics-of-nanotechnology/>

Manufacturing

Precision Manufacturing

Material Reuse

Miniaturization

Medicine

Pharmaceutical Creation

Disease Treatment

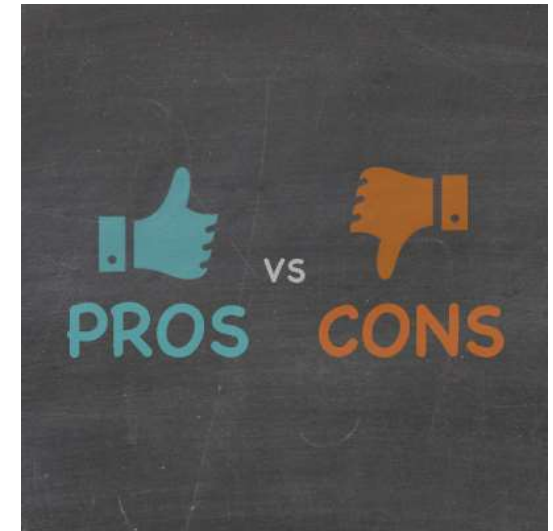
Nanomachine-assisted Surgery

Environment

Toxin Cleanup

Recycling

Resource Consumption Reduction



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Weapons

Miniature Weapons and Explosives

Disassemblers for Military Use

Rampant Nanomachines

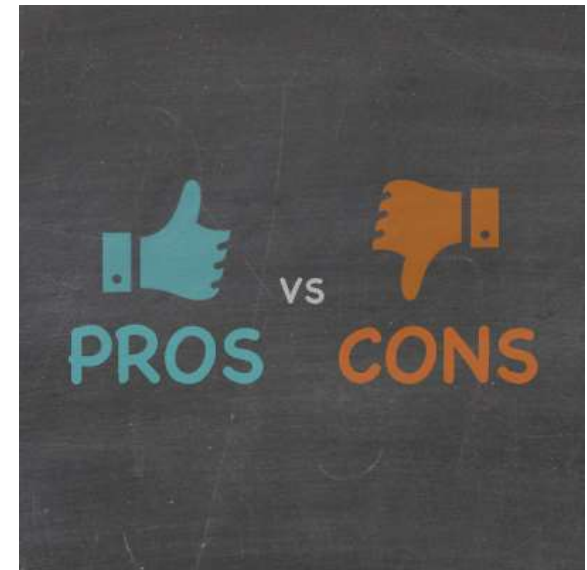
Self Replicating Nanomachines

The Gray Goo Scenario

Surveillance

Monitoring

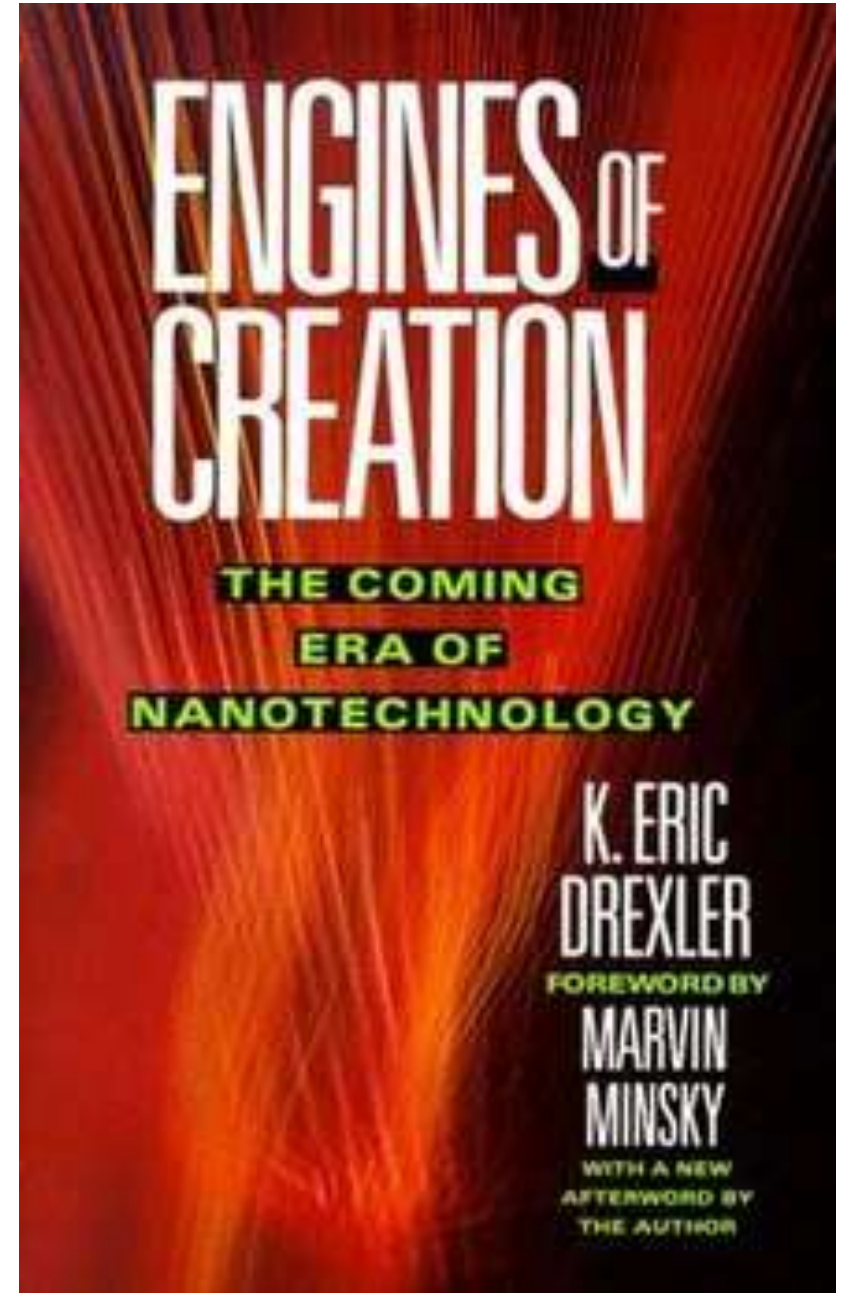
Tracking



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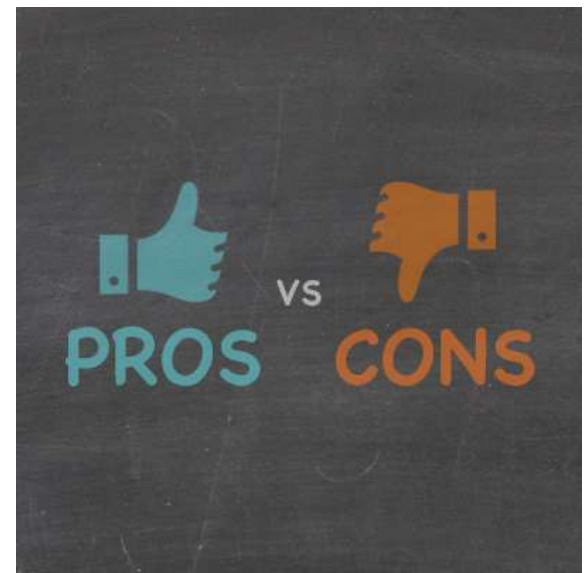
Note: Gray Goo Scenario =
self-replicating robots
consuming all biomass on
Earth while building more of
themselves

<https://foresight.org/>



Possible guidelines

- Nanomachines should only be specialized, not general purpose
- Nanomachines should not be self replicating
- Nanomachines should not be made to use an abundant natural compound as fuel
- Nanomachines should be tagged so that they can be tracked



Against nano for
weapons?

Campaign to stop autonomous lethal
weapons,

<https://www.stopkillerrobots.org/>

Video:

<https://www.youtube.com/watch?v=TlO2gcs1YvM>

Article:

<https://ijermt.org/publication/36/IJERMT%20V-5-5-5.pdf>

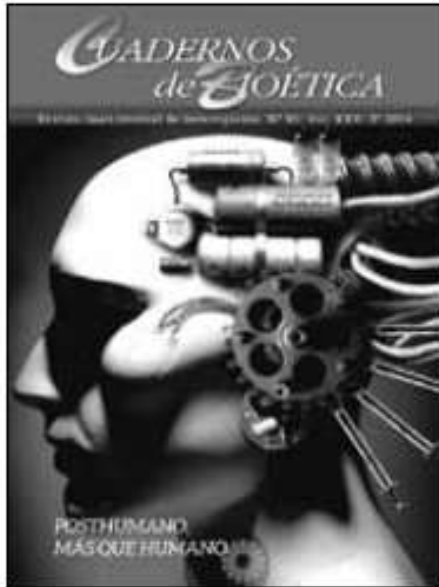
Nano for trans-humanism?

Will GRIN technologies (-geno, -robo, -info, -nano) change the inner constitution of human body?

Nano for trans-humanism?

Cuadernos de Bioética XXV 2014/3ª

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FROM DARWINIAN TO TECHNOLOGICAL EVOLUTION: FORGETTING THE HUMAN LOTTERY

DESDE LA EVOLUCIÓN DARWINIANA A LA TECNOLÓGICA:
OLVIDAR LA LOTERÍA HUMANA

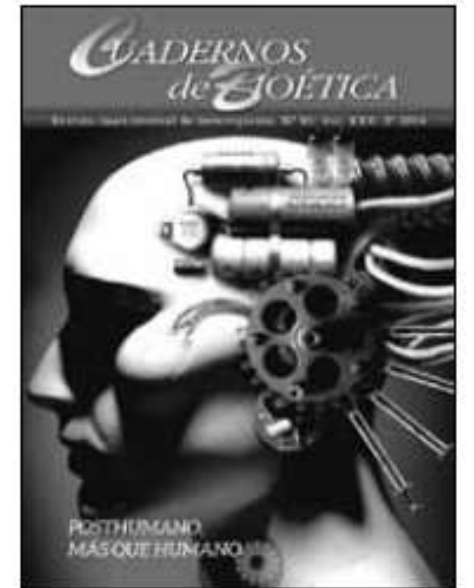
GIORGIO TINTINO

University of Macerata

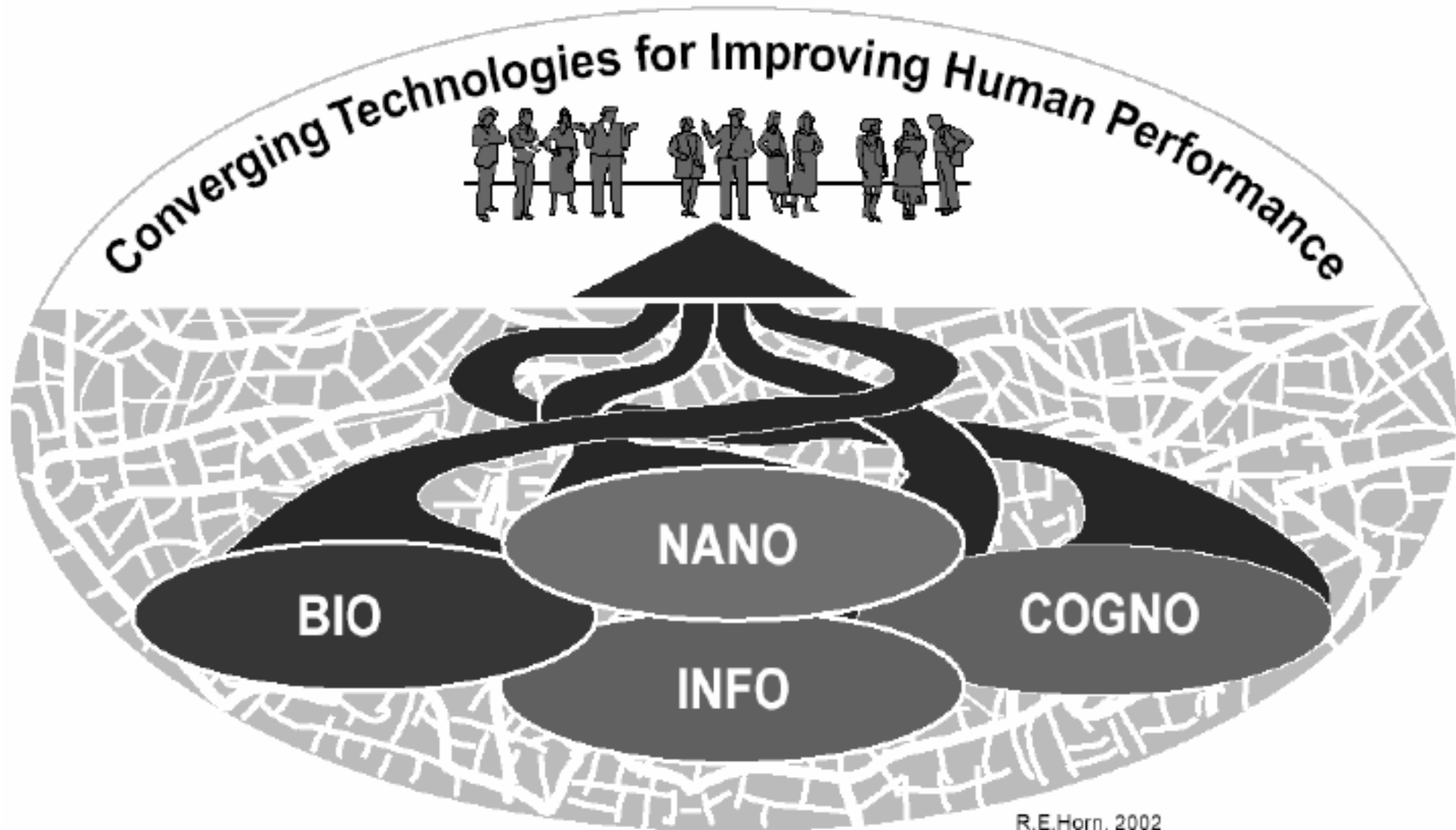
tinto13@alice.it

Nano for trans-humanism?

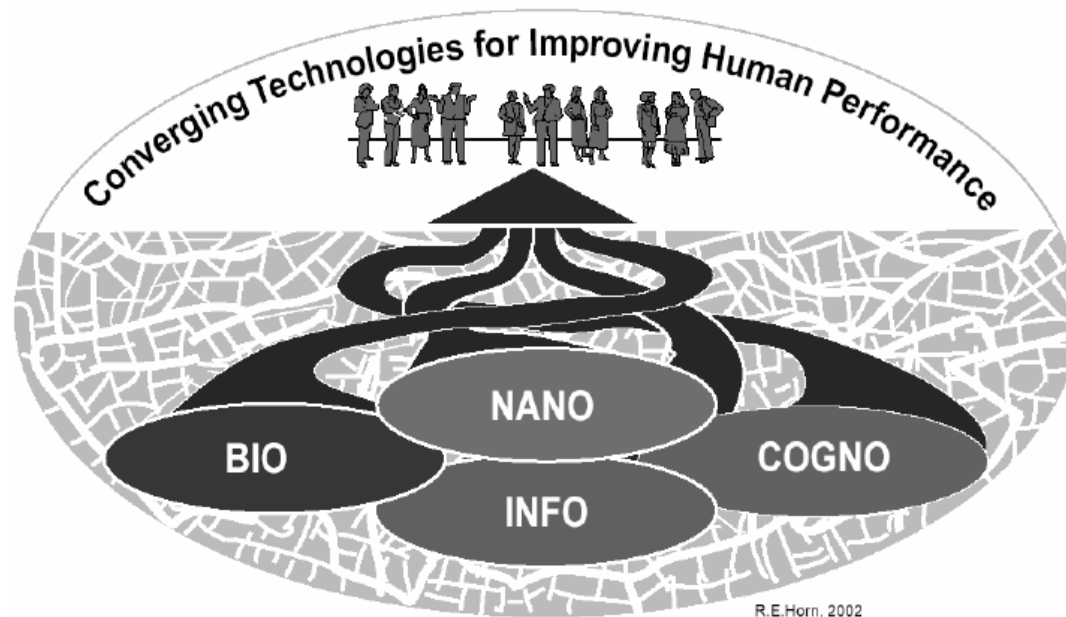
“The human being finds his partner of evolution in technology, a partner who doesn't remain outside his biological constitution but penetrates the inmost of its processes”



A criticized (in the EU) report coming from the US

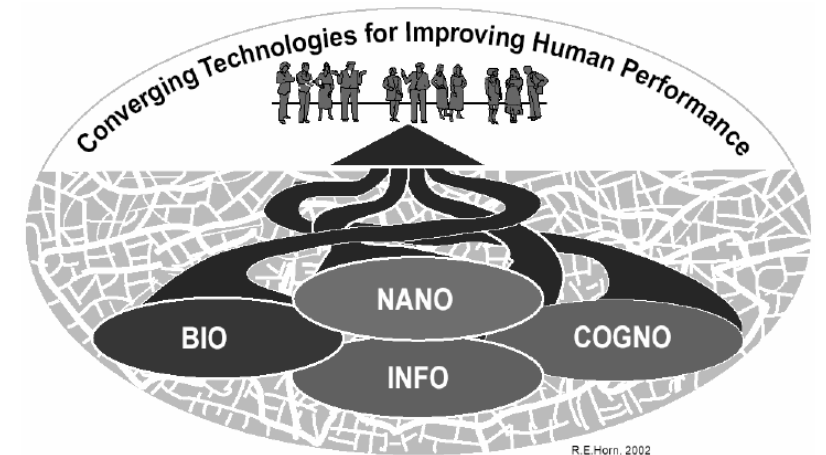


Funded by U.S. National Science Foundation and Department of Commerce; known as the **NBIC** report (Nanotechnology, Biotechnology, Information Technology, and Cognitive Science)



Roco, M.C., and Bainbridge, W.S. (eds) (2002) Converging technologies for improving human performance, NSF-DOC Report, Kluwer, 2003.

- Expanding human cognition and communication,
- Improving human health and physical capabilities,
- Enhancing group and societal outcomes,
- National security,
- Unifying science and education



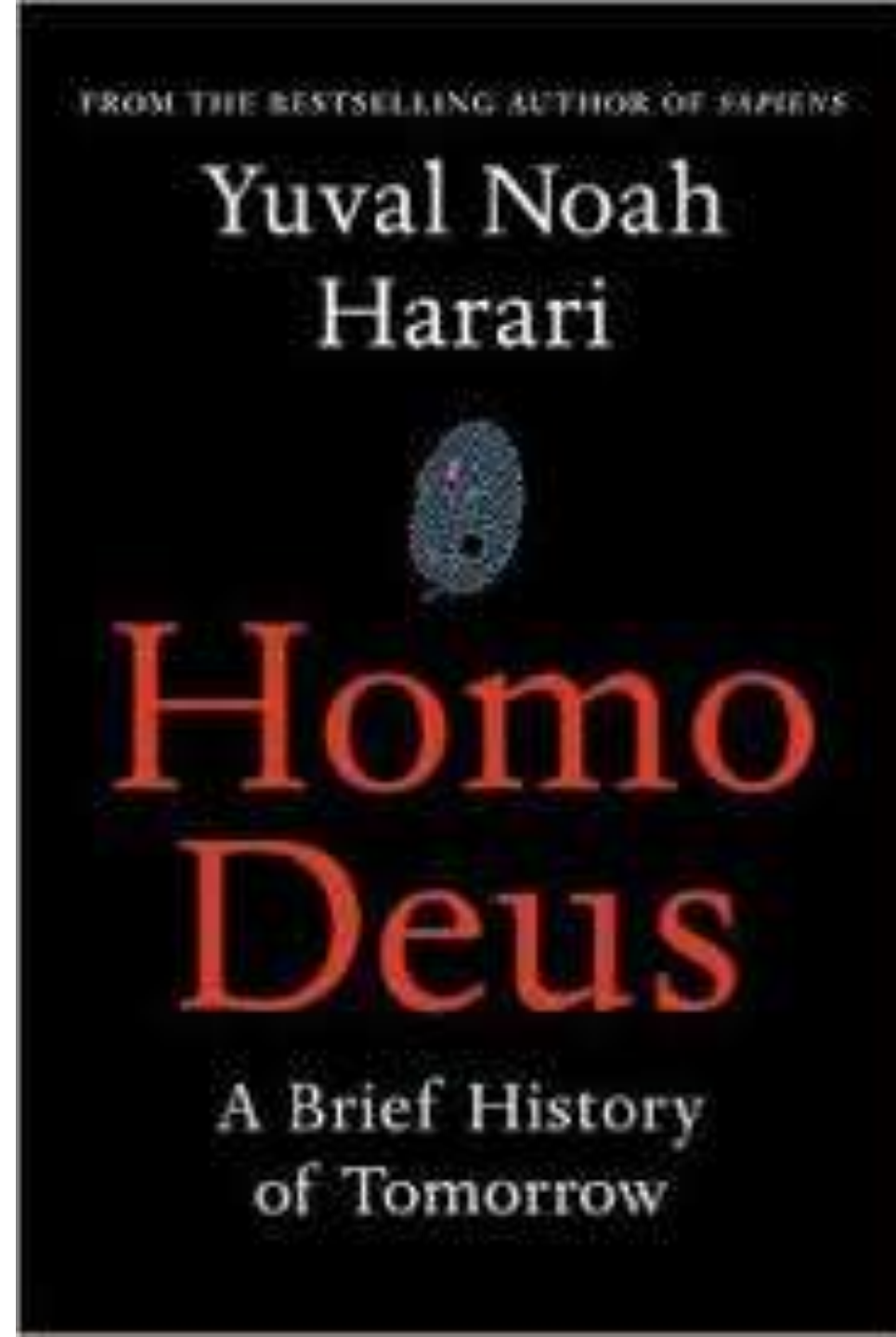
Harari's reading

“Solving death?”

“Upgrading humans into gods?”

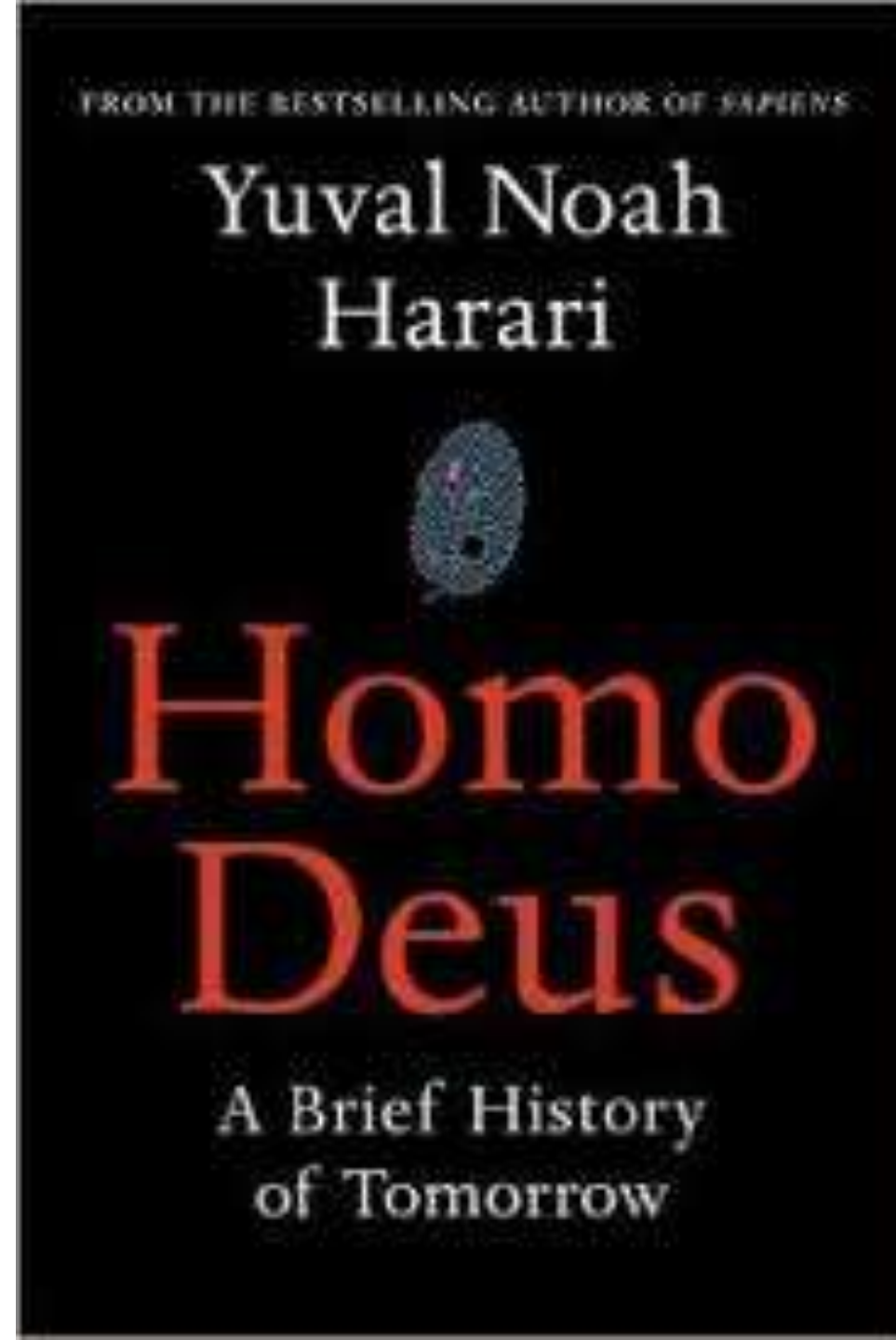
“Human bid for divinity certain”

“Nobody can hit the brakes”



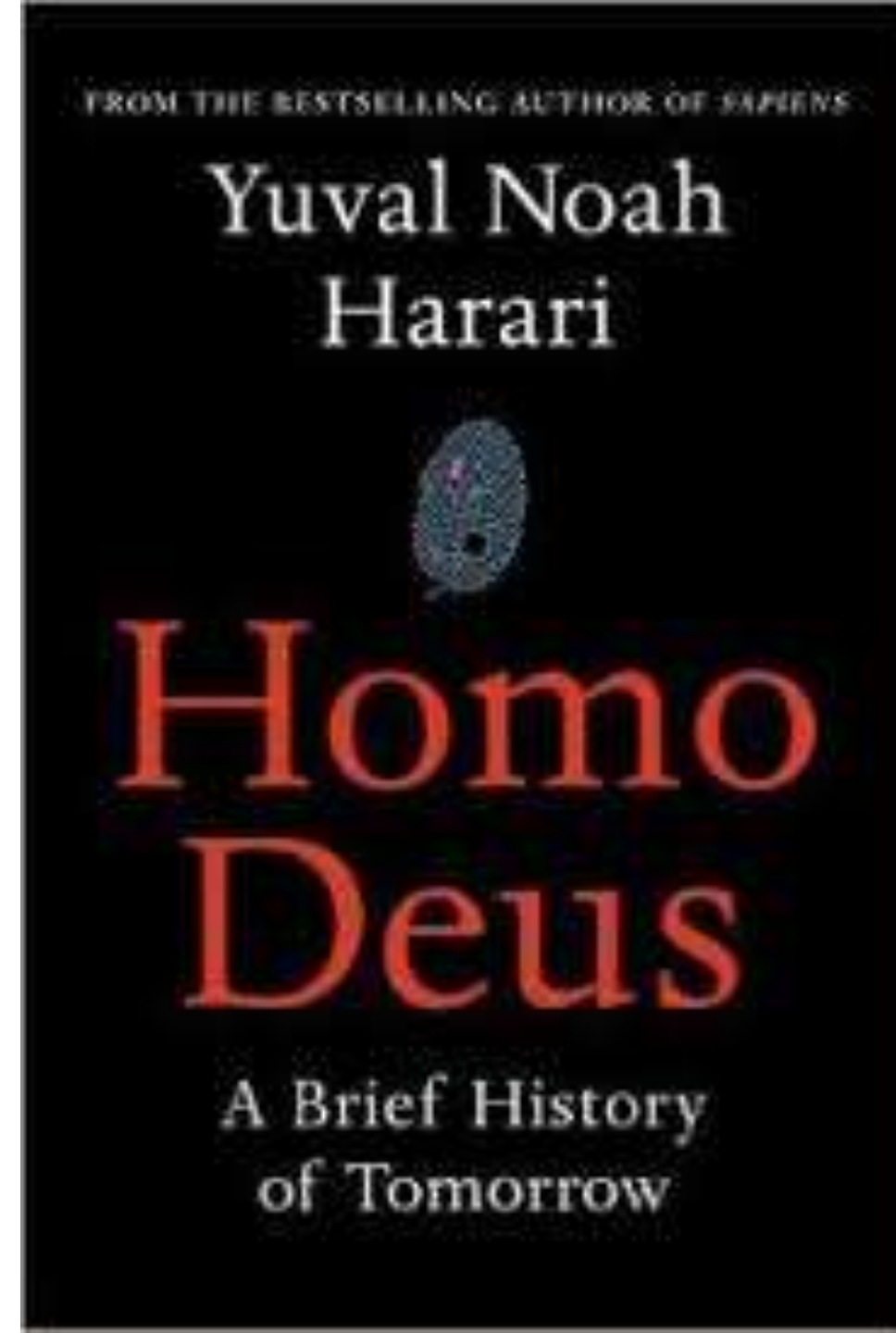
Harari's reading

“...human bodies will incorporate a host of biometric devices, bionic organs and nano-robots, which will ... defend us from infections...online 24/7 ...”

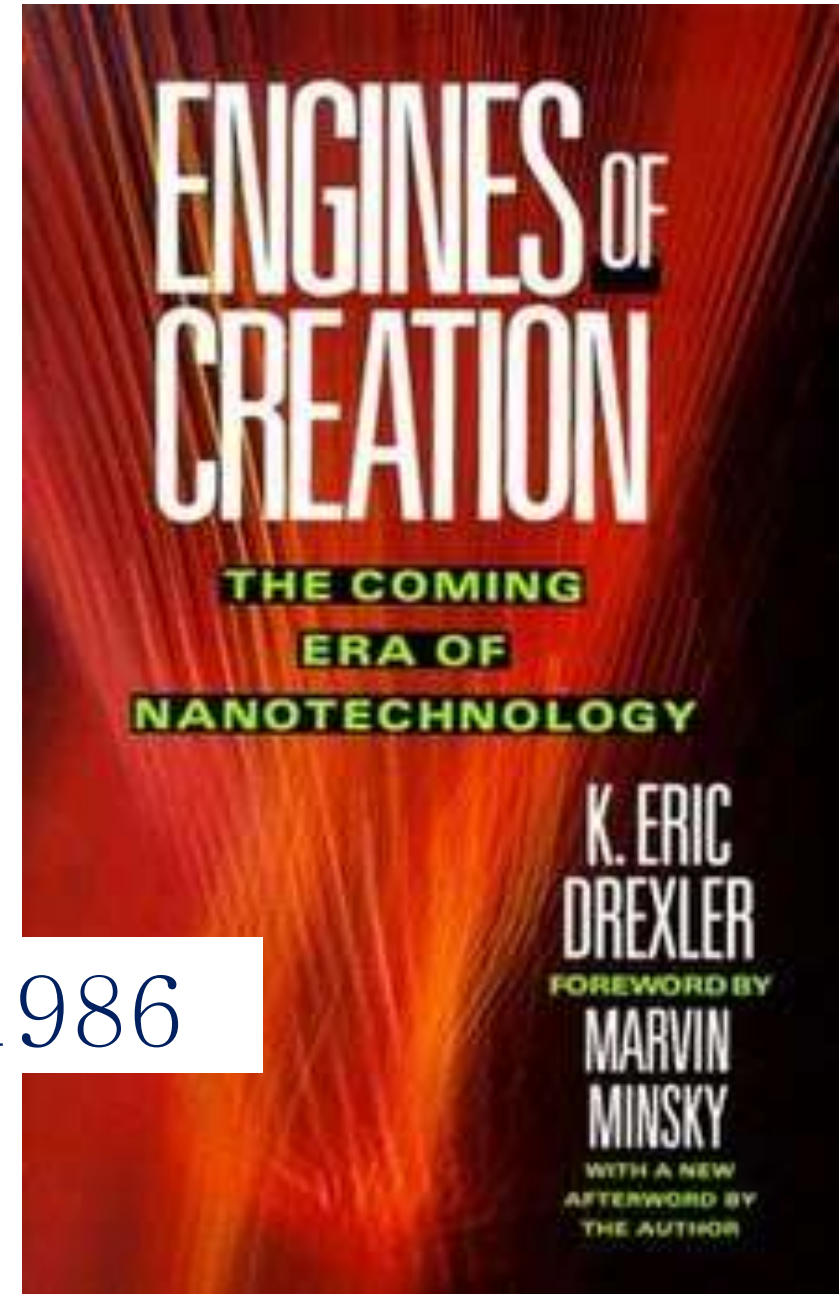
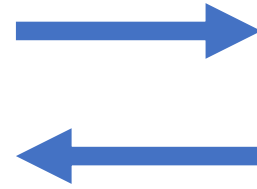


Harari's reading

“... if I don't upgrade my antivirus regularly I might discover that the millions of nano-robots coursing through my veins are now controlled by a North Korean hacker.”



Richard P. Feynman, There's Plenty of Room at the Bottom, Speech at Caltech, December 29, 1959.



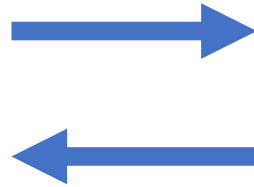
1986

https://en.wikipedia.org/wiki/There%27s_Plenty_of_Room_at_the_Bottom

See also <http://www.zyvex.com/nano>

Richard Feynman versus Erik Drexler

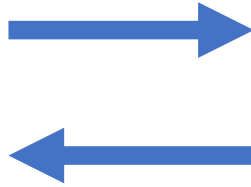
1959 versus 1986



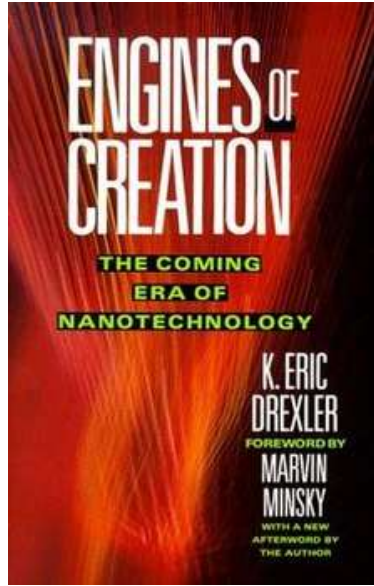
Both enthusiasts, and yet different worlds ...

https://en.wikipedia.org/wiki/There%27s_Plenty_of_Room_at_the_Bottom
See also <http://www.zyvex.com/nano>

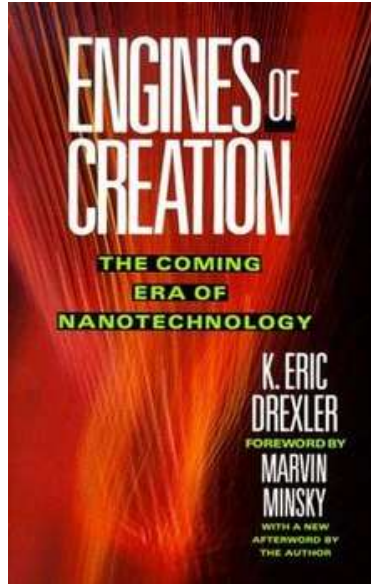
For both Feynman and Drexler nano
holds promises of wonders



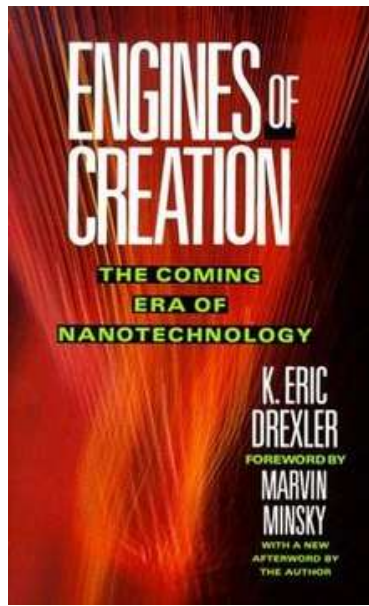
And yet Drexler sees dangers which
Feynman doesn't. Was the innocence
lost?



For Drexler (1986) nano will cure environmental degradation, postpone death, allow space travels, stop killer asteroids, solve the problem of nuclear waste, make 'Jurassic Park' possible, no more limits to growth, prosperity for all ...



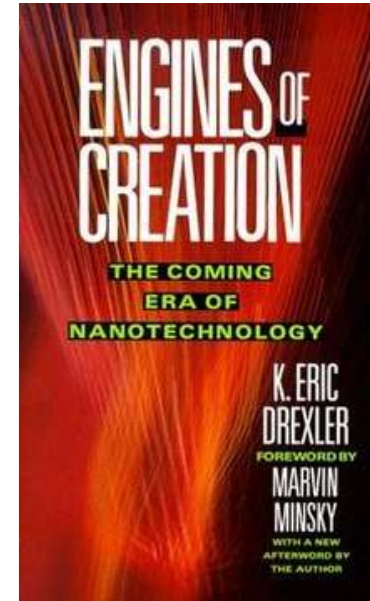
“... a world with machines that don’t clank, chemical plants that don’t stink, and production systems that don’t use people as cogs.”



Unlike Feynman, Drexler predicts nanomachines which can reproduce themselves

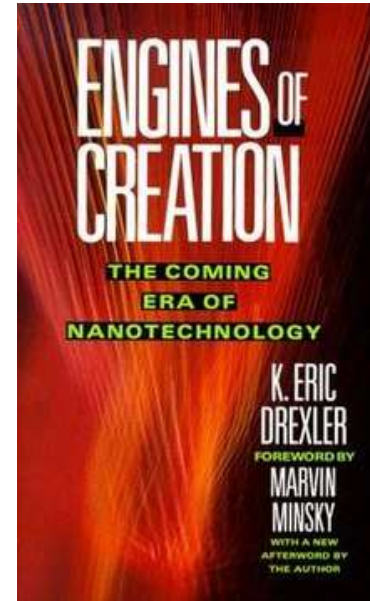
“As we look forward to see where the technology race leads, we should ask three questions: what is *possible*, what is *achievable*, and what is *desirable*”

“Will we develop monster technologies before cage technologies or after?
Some monsters, once loosed, cannot be caged”



Dangers ahead (in chapter 11 'Engines of Destruction')

- Grey Goo scenario
(a single accident fatal)
- Nano will favour
dictatorships against
democracies [see AI]
- Military applications almost
impossible to ban/control



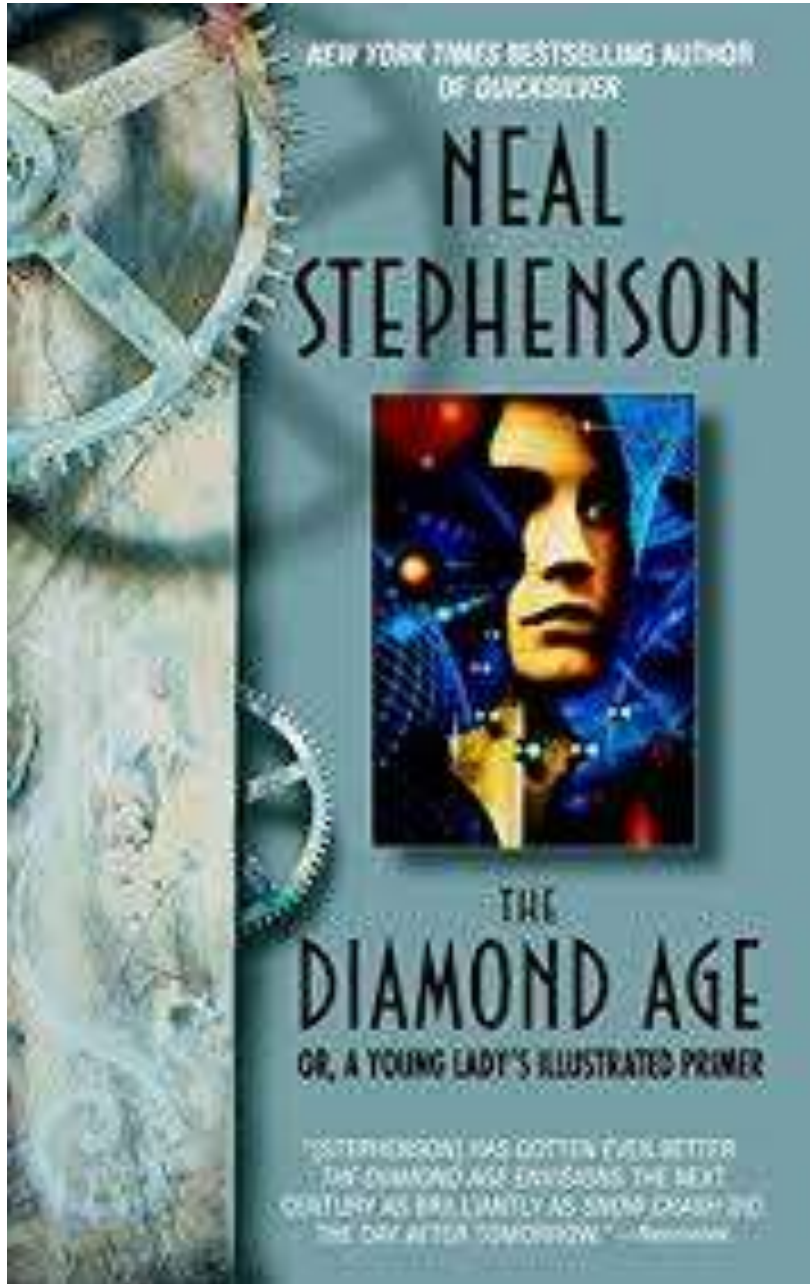


Feynman's battles in the Rogers commission for the Challenger disaster in 1986, see
<https://www.youtube.com/watch?v=4kpDg7MjHps>



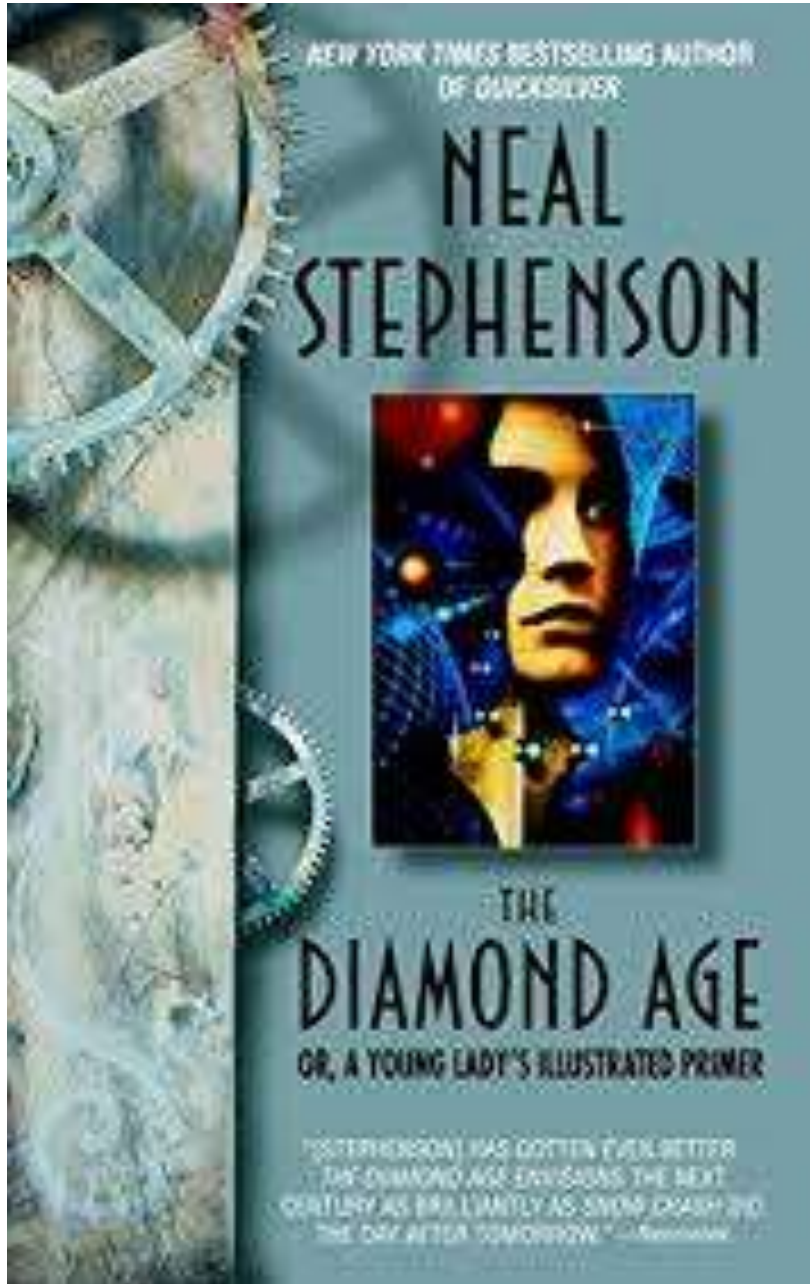
Feynman: “not an accident”,
<https://www.youtube.com/watch?v=4kpDg7MjHps>

Fiction's corner



Neal Stephenson, The Diamond Age or a young lady illustrated primer

Tells the coming of age story of a marginal girl in a world of ubiquitous nanotechnology (on the tap, as well as airborne) with class, power and technology conflicts; Feynman and Drexler mentioned (also recommended in an academic paper



Also recommended in an
academic paper

*Teaching Societal and Ethical Implications of
Nanotechnology to Engineering Students
Through Science Fiction*

Rosalyn W. Berne
University of Virginia

Joachim Schummer
Technical University of Darmstadt

<https://sci-hub.st/https://doi.org/10.1177/0270467605283048>



Note: New social media making us ... worse persons in a popular book of Jaron Lanier

Black Mirror (Hated in the Nation)
Nano plus twitter in a sinister plot to educate the public against intolerance, the hard way



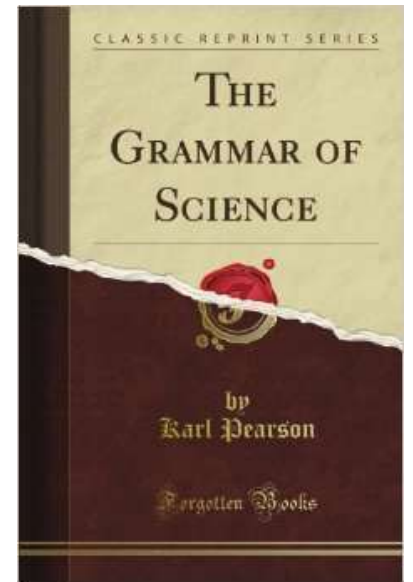
How are we taught our
science; the good and
the truth; from the
Vienna circle to ...

How are we taught
our science?

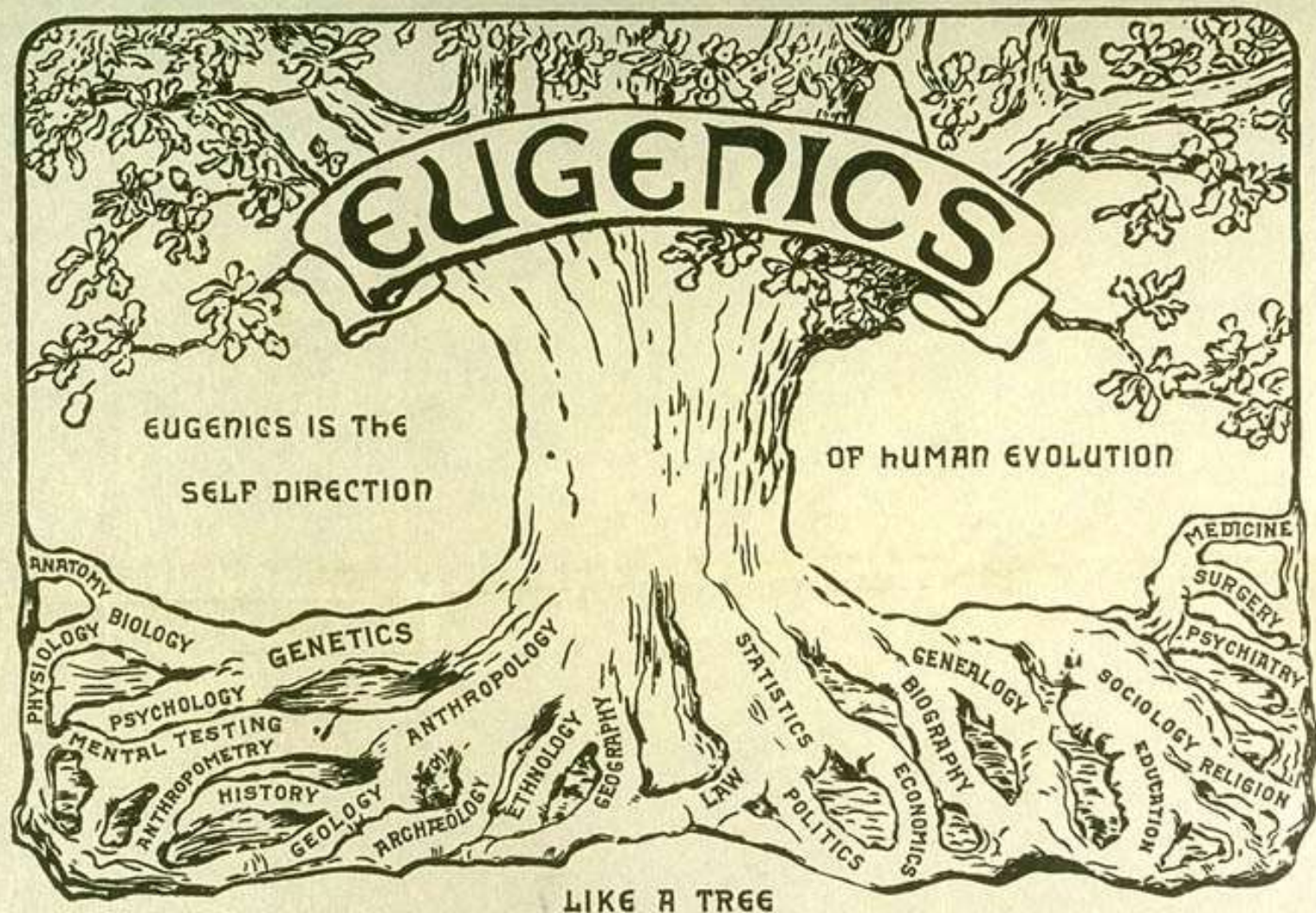
Karl Pearson (a social Darwinist) suggests not wasting resources on social programs as:

“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

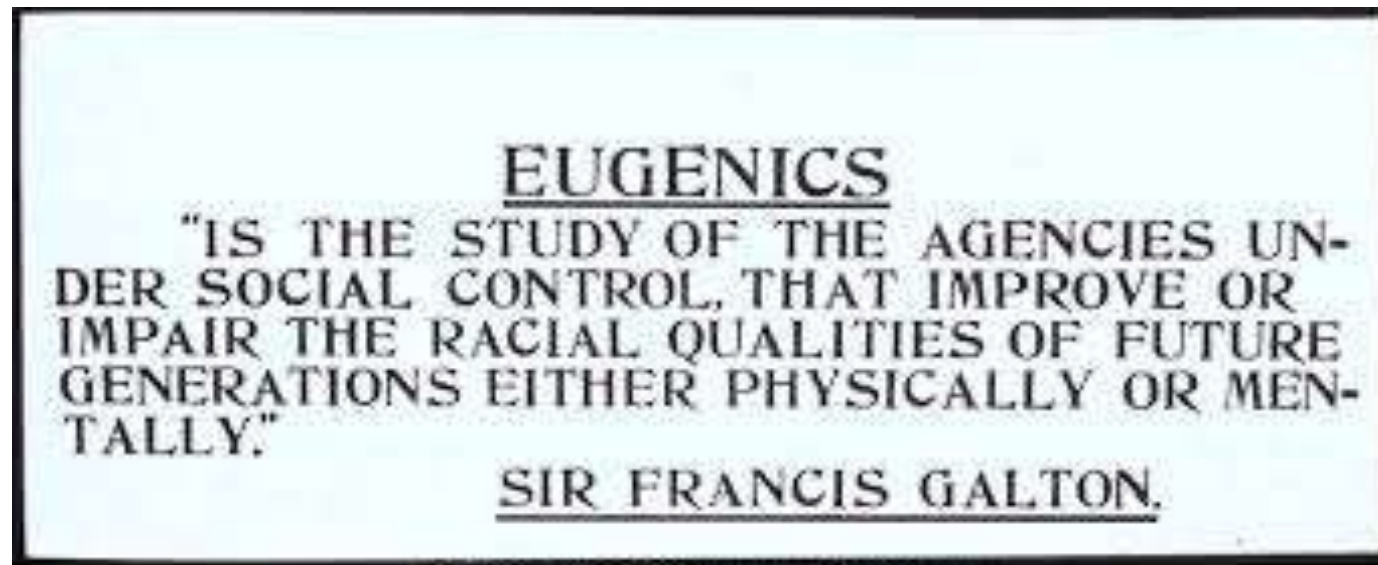


Pearson, K., 1892, The Grammar of Science, Walter Scott Publisher, London, p.32.

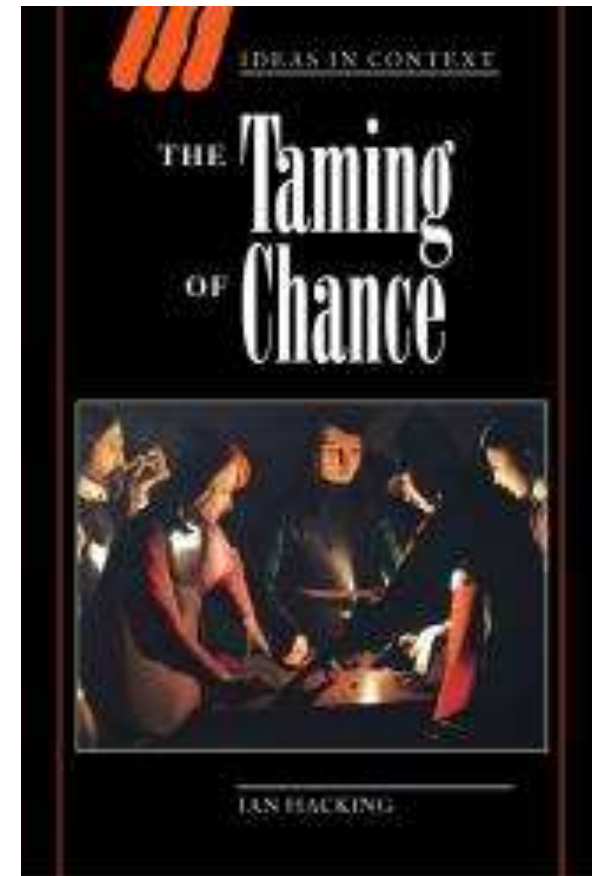


LIKE A TREE
EUGENICS DRAWS ITS MATERIALS FROM MANY SOURCES AND ORGANIZES
THEM INTO AN HARMONIOUS ENTITY.

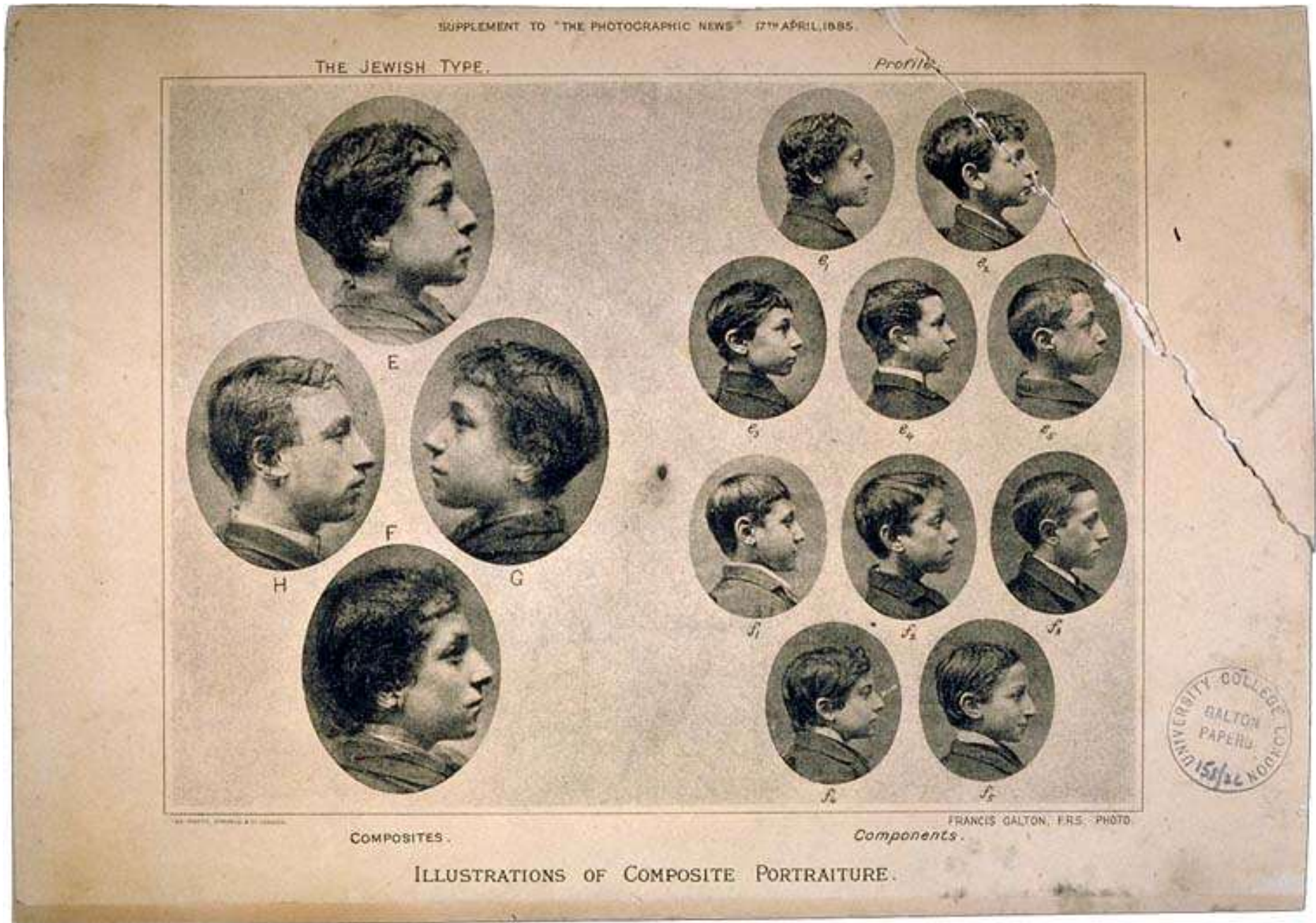
Francis Galton and Karl Pearson (the one of chi-squared); laboratory of biometrics; distinguishing army officers from private soldiers from criminals convicted of murder from non-violent felons from Jews ...



Toronto State University. Noncommercial, educational use only.



The Jewish type ...



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"Eugenics is the study of all of the agencies under social control which may improve or remedy the inheritable qualities of future generations of man, either physically or mentally."

—Francis Galton



VOLUME II

AUGUST 1929

NUMBER 3

CONSTITUTED AND PRINTED BY THE EUGENICS SOCIETY
COURTESY OF THE EUGENICS SOCIETY, 1929

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 ...

IN PRACTICE

Young statistician,
you shall live in
adventurous times



The so-called "crisis in science" presents challenges for statisticians starting out in their career. But there are strategies for survival, says **Andrea Saltelli**

SIGNIFICANCE

ROYAL
STATISTICAL
SOCIETY
SOCIAL EVOLUTION | BIOSTATISTICS

ASA
AMERICAN STATISTICAL ASSOCIATION
Promoting the Practice and Profession of Statistics

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

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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)

Verification or falsification?

Karl Popper

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

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Truth cannot be verified: it can only be falsified



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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

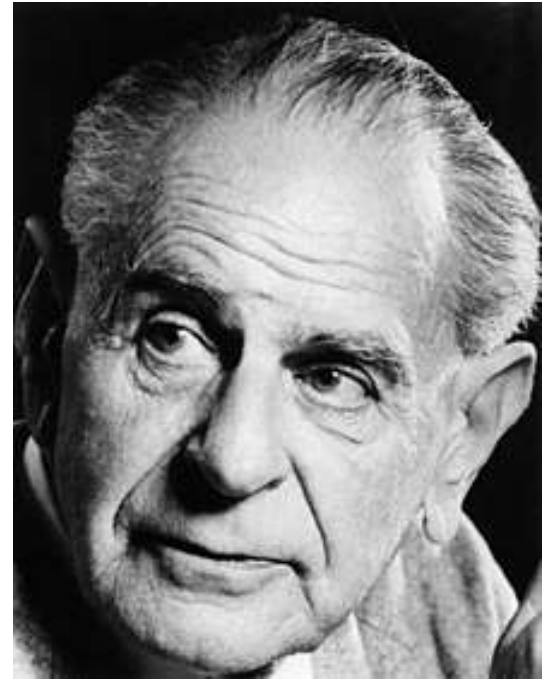
Demarcation science/non-science → Marxist historiography and psychoanalysis are not science



Verification or falsification?

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

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



Karl R. Popper
1902–1994

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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?

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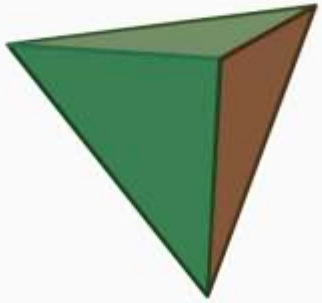
Ideological Commitments in the Philosophy of Science

With a Comment on Ravetz by Edgley

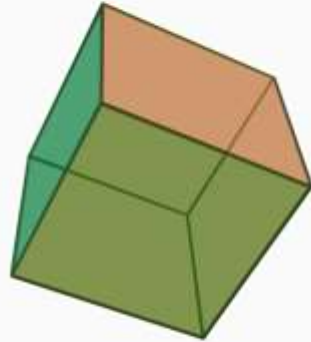
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Euler's Polyhedron Formula

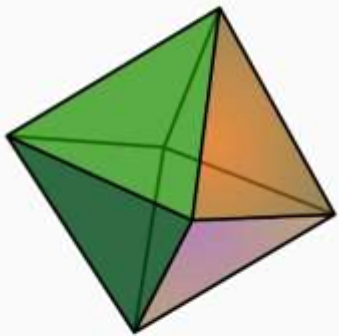
$$\text{Vertices} - \text{Edges} + \text{Faces} = 2$$



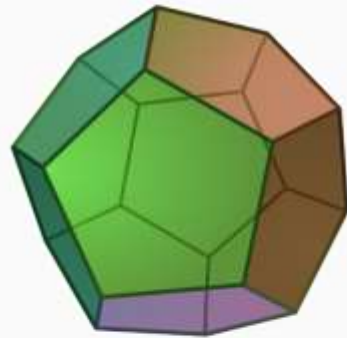
$$V = 4 \quad E = 6 \quad F = 4$$
$$4 - 6 + 4 = 2$$



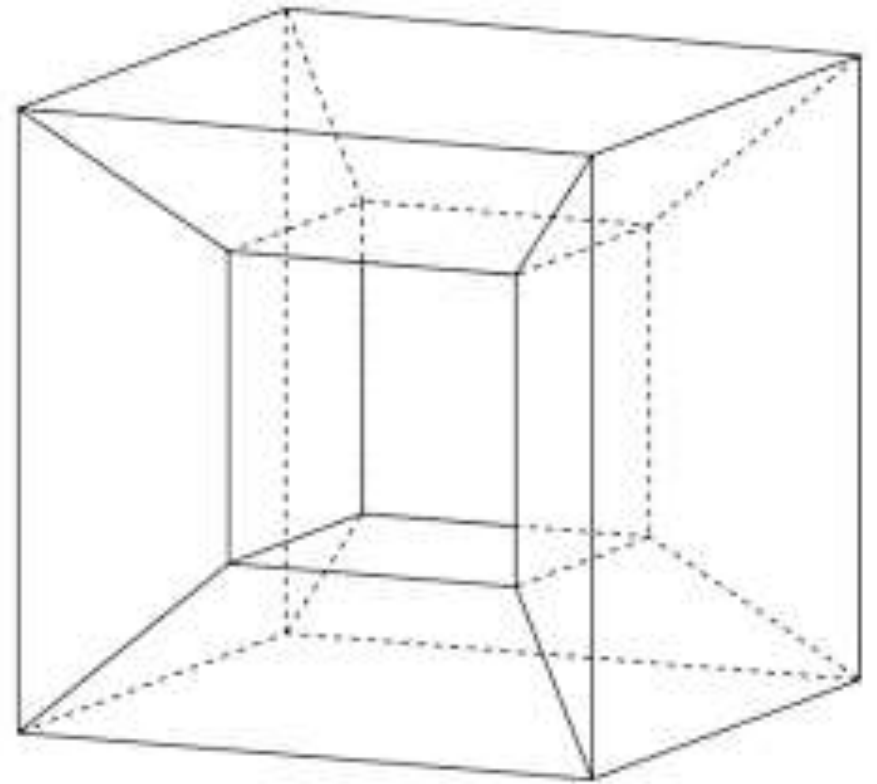
$$V = 8 \quad E = 12 \quad F = 6$$
$$8 - 12 + 6 = 2$$



$$V = 6 \quad E = 12 \quad F = 8$$
$$6 - 12 + 8 = 2$$



$$V = 20 \quad E = 30 \quad F = 12$$
$$20 - 30 + 12 = 2$$



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’

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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?)

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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)

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



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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

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Ideological Commitments in the Philosophy of Science

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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

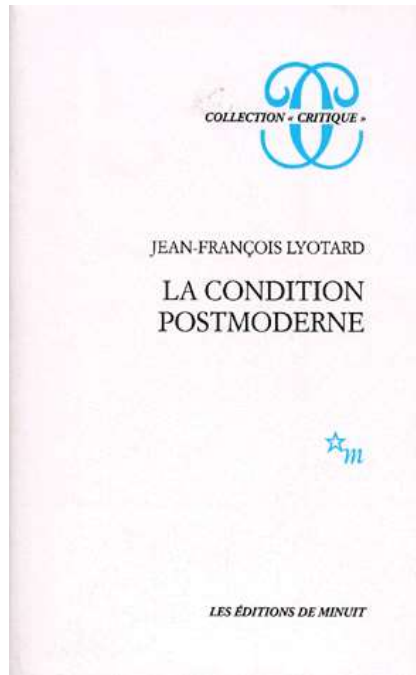
For Lyotard the grand
narrative of the relation
between knowledge/science
and power has come to an end



Jean-François Lyotard

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

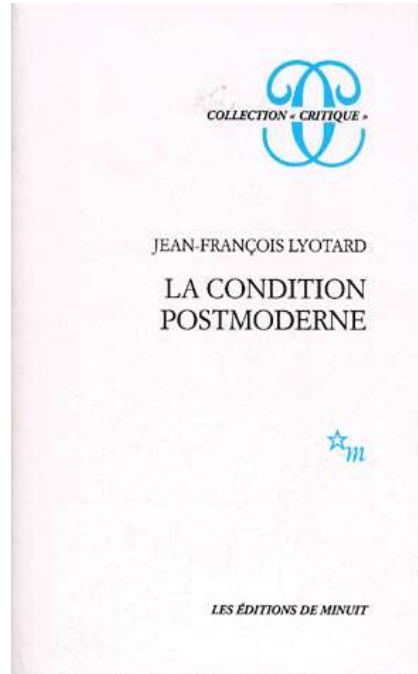
“The question of the legitimacy of science has been indissociably linked to that of the legitimation of the legislator since the time of Plato.”



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

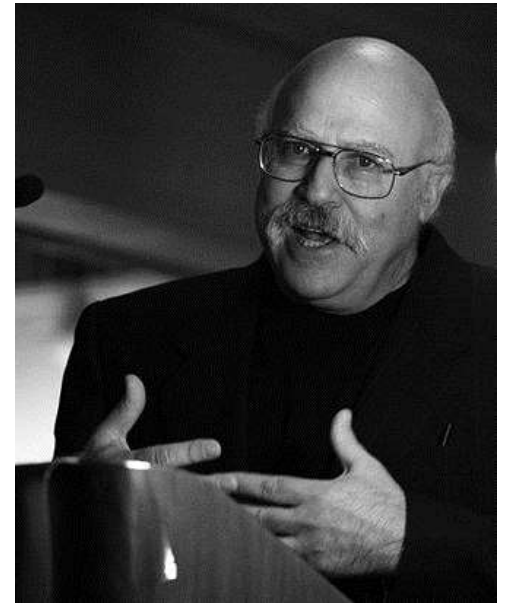
Lyotard, J.-F. 1979. La Condition postmoderne. Rapport sur le savoir, Paris : Minuit.

“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.”



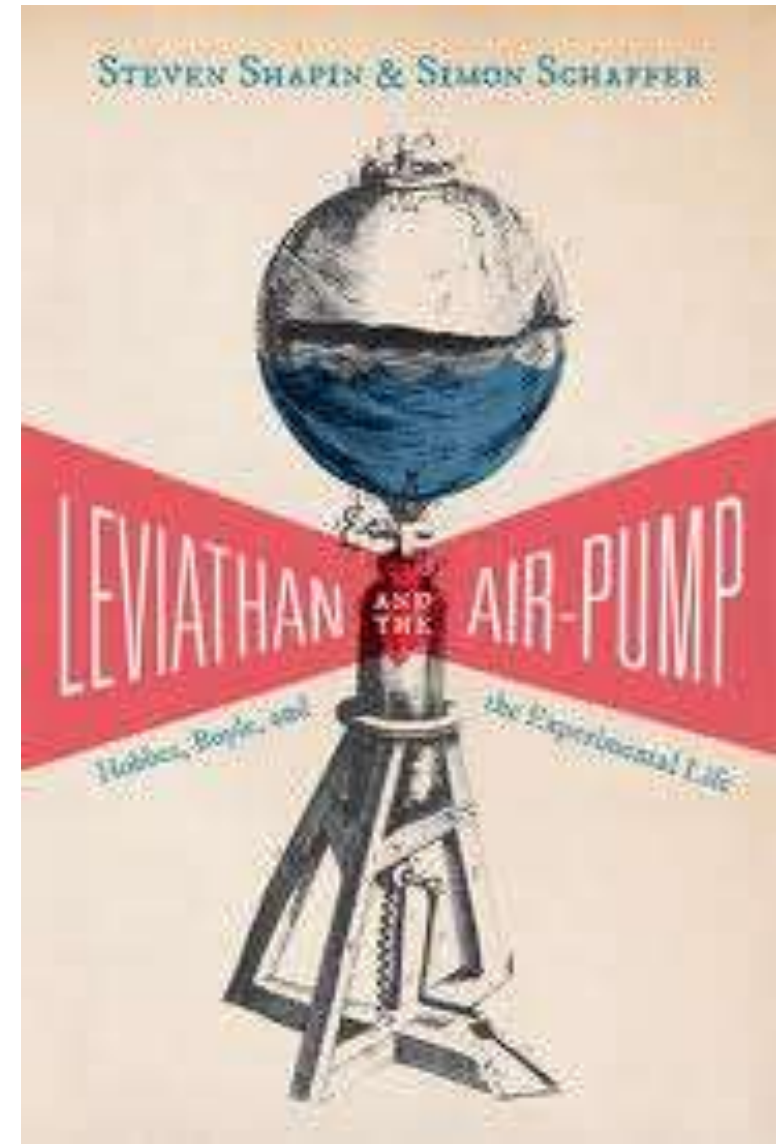
Simon Schaffer



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 ...

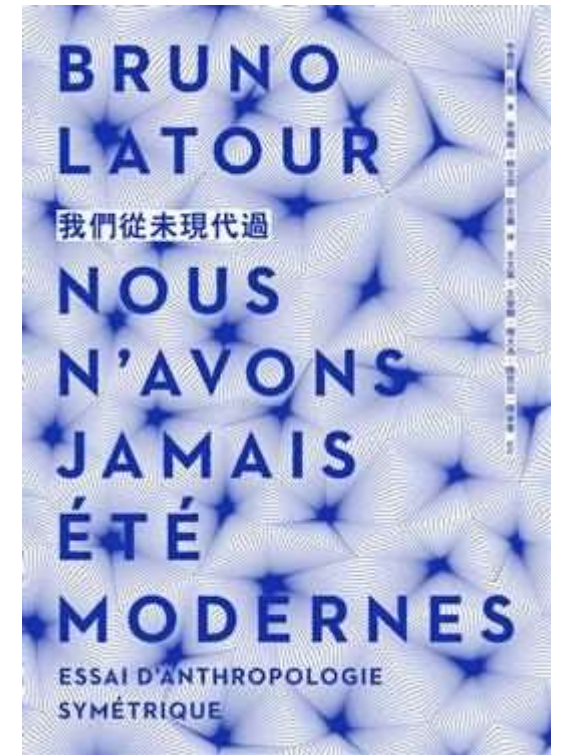


Shapin, S., Schaffer, S., 1985, Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life, Princeton, 2011 Edition

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

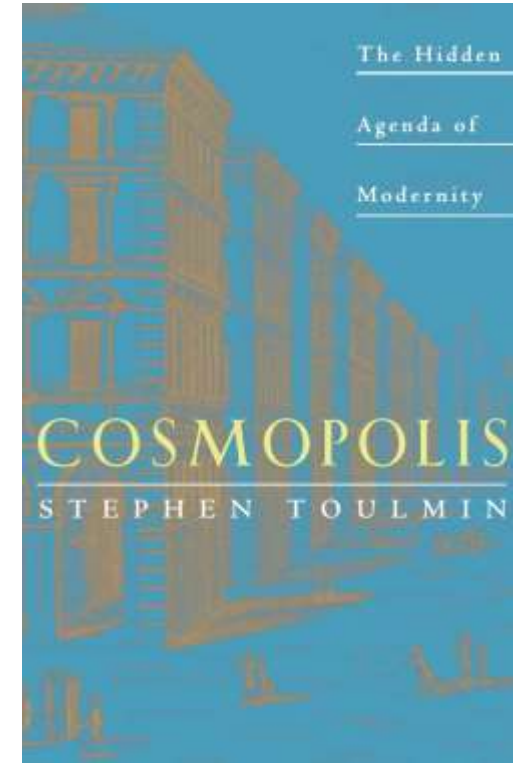


Latour, B., 1991, Nous n'avons jamais été modernes, Editions La découverte, 1993; We Have Never Been Modern. Cambridge, Harvard UP.

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



Stephen Toulmin

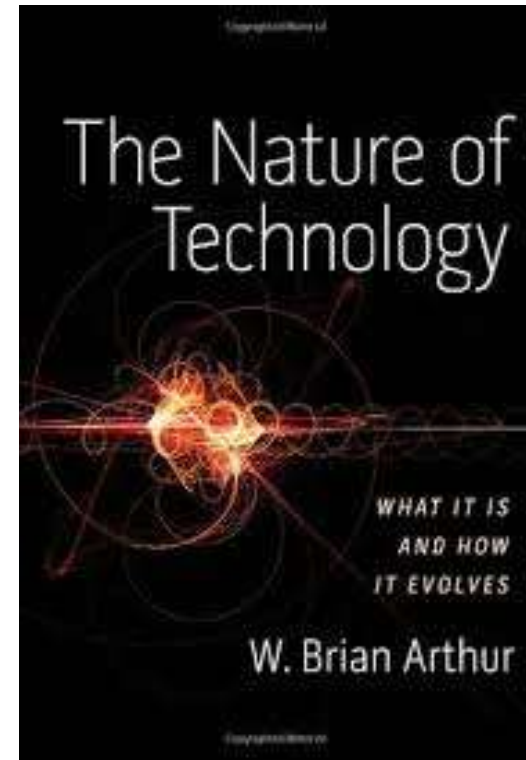


Stephen Toulmin, 1990, *Cosmopolis: The Hidden Agenda of Modernity*, The University of Chicago Press.

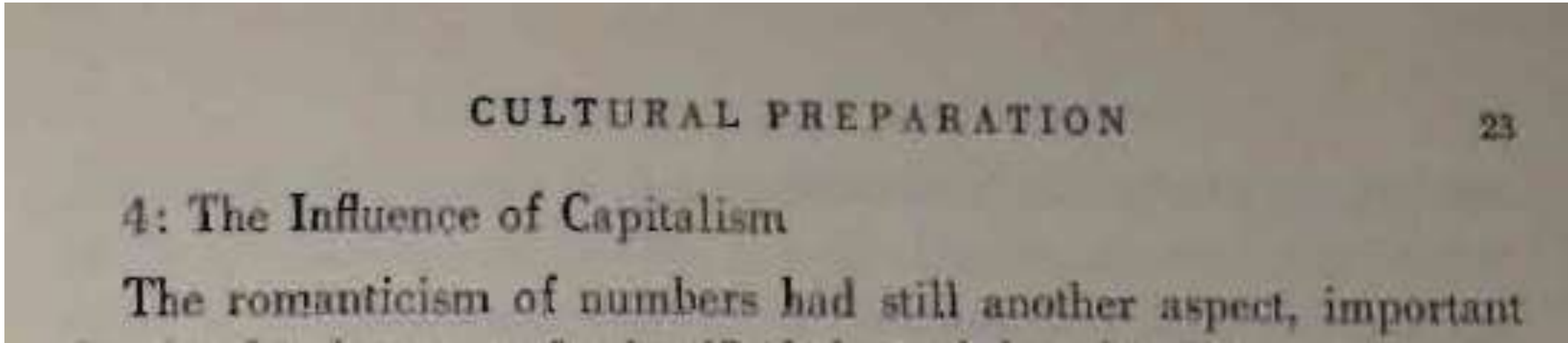
Mastering the
technique / science /
the machine

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



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

“The necessity to promote continual changes and improvements, which has been characteristic of capitalism, introduced an element of instability into technics and kept society from assimilating its mechanical improvements and integrating them in an appropriate social pattern”

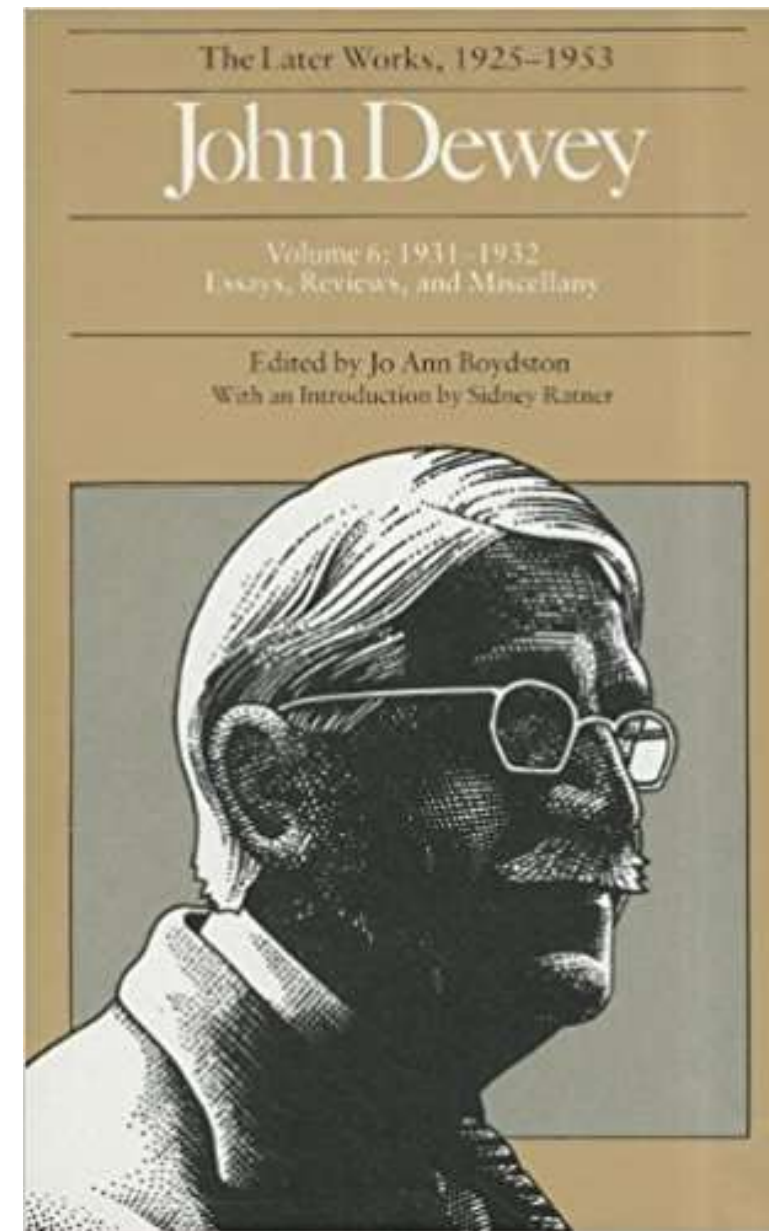


Lewis Mumford,
1895–1990

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

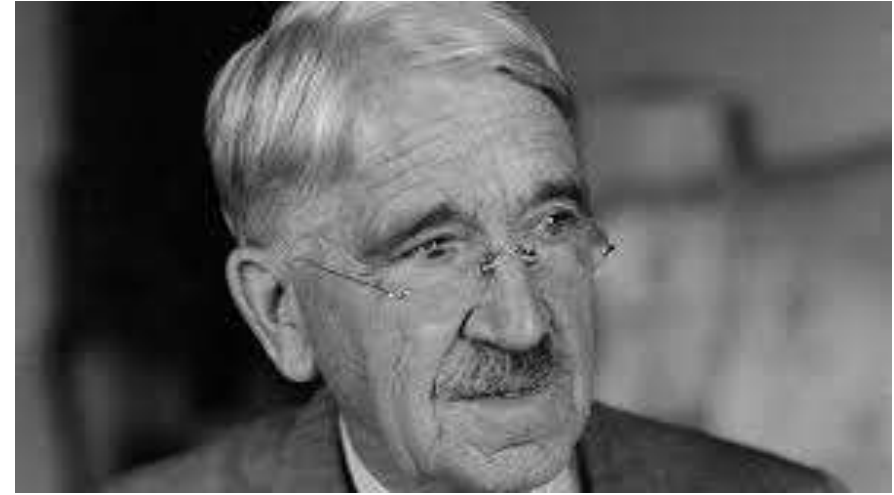
Here lies the heart of our present social problem. Science has hardly been used to modify men's fundamental acts and attitudes in social matters. It has been used to extend enormously the scope and power of interests and values which anteceded its rise. Here is the contradiction in our civilization. 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”



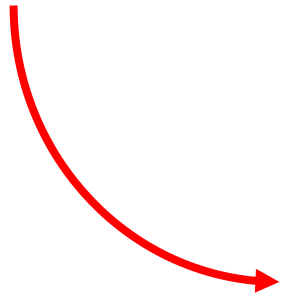
John Dewey

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

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

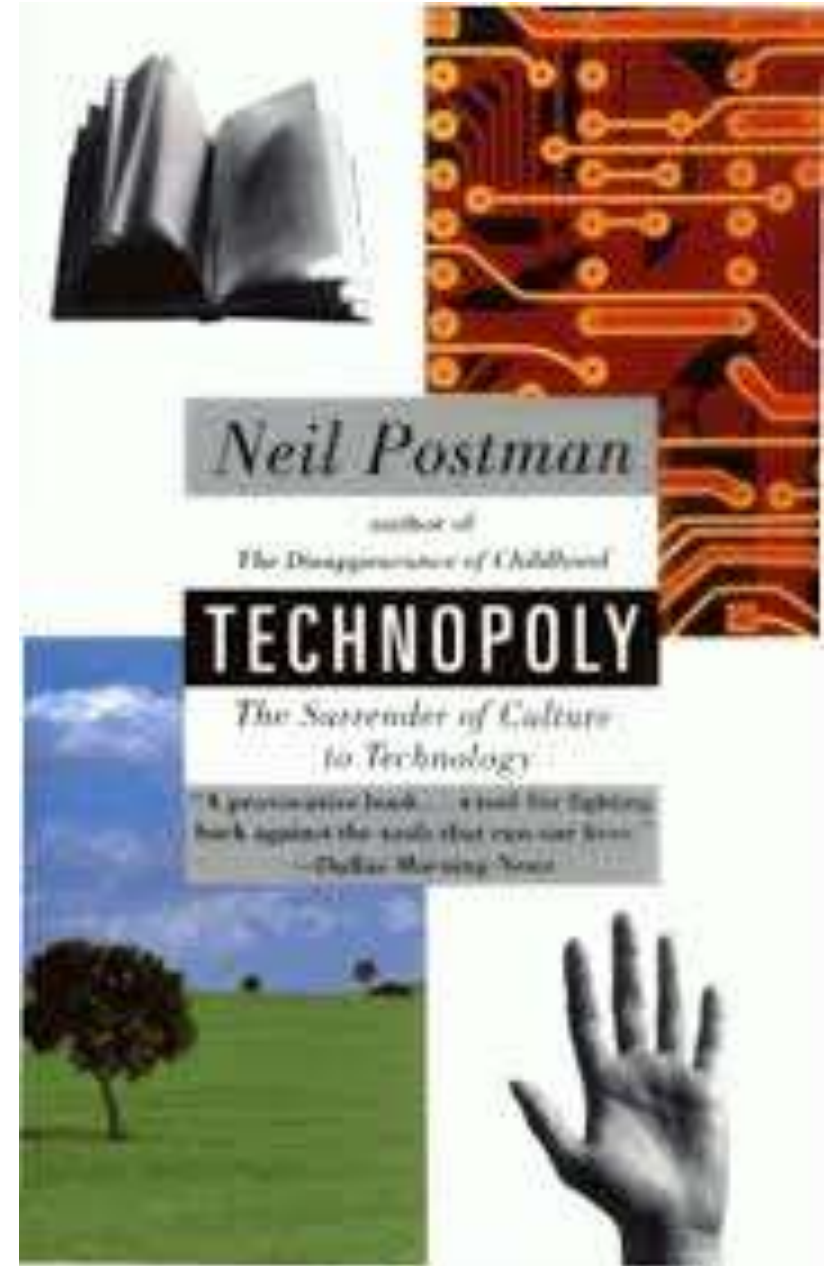


E. F. Schumacher, 1973, *Small Is Beautiful. Economics as if People Mattered*, Penguin Perennial.

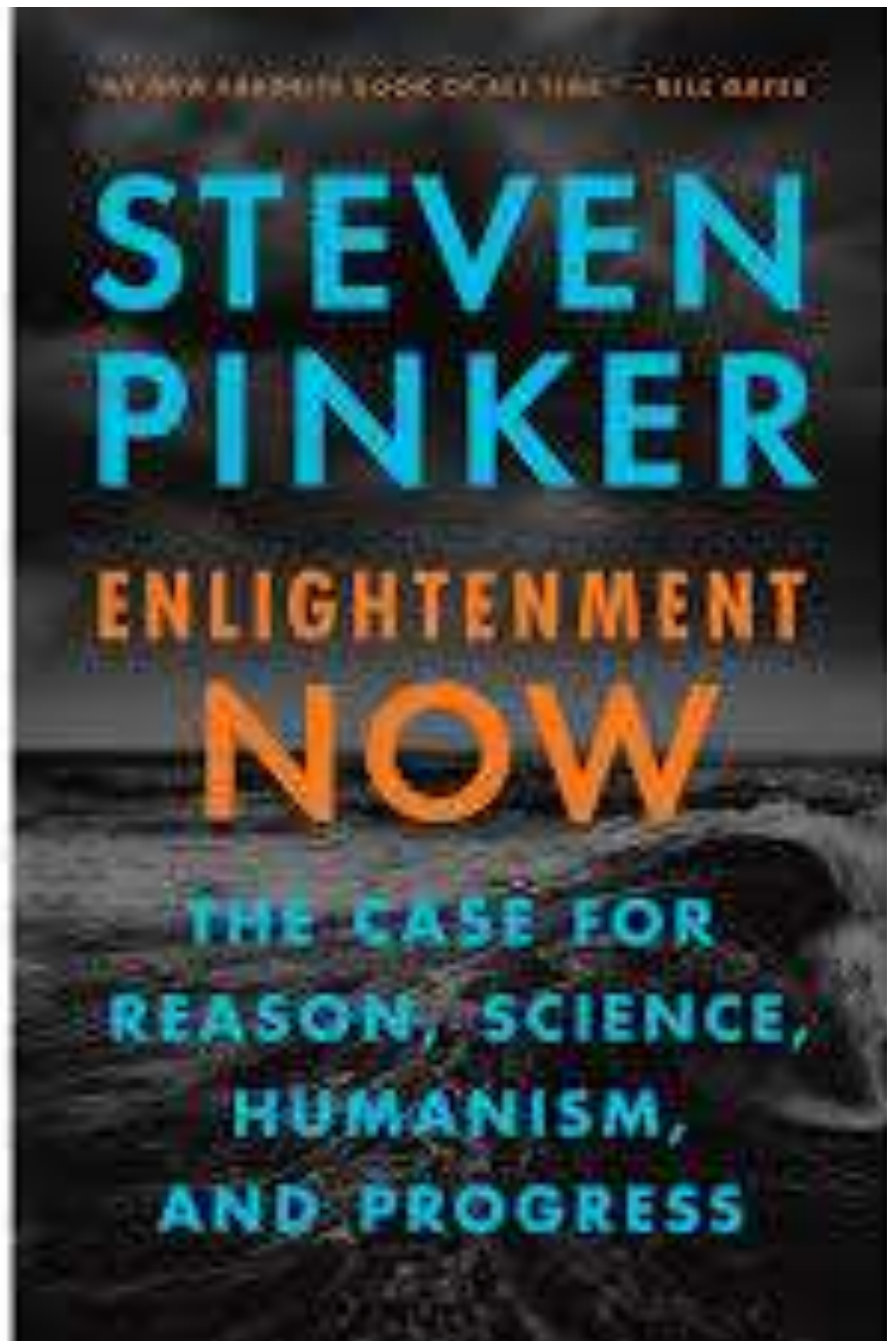
Winner, L., 1986. *The Whale and the Reactor: a Search for Limits in an Age of High Technology*. The University of Chicago Press, 1989 edition.

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.

“... 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

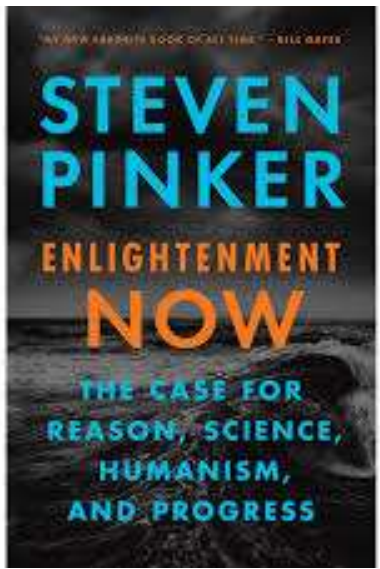


Steven Pinker



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...

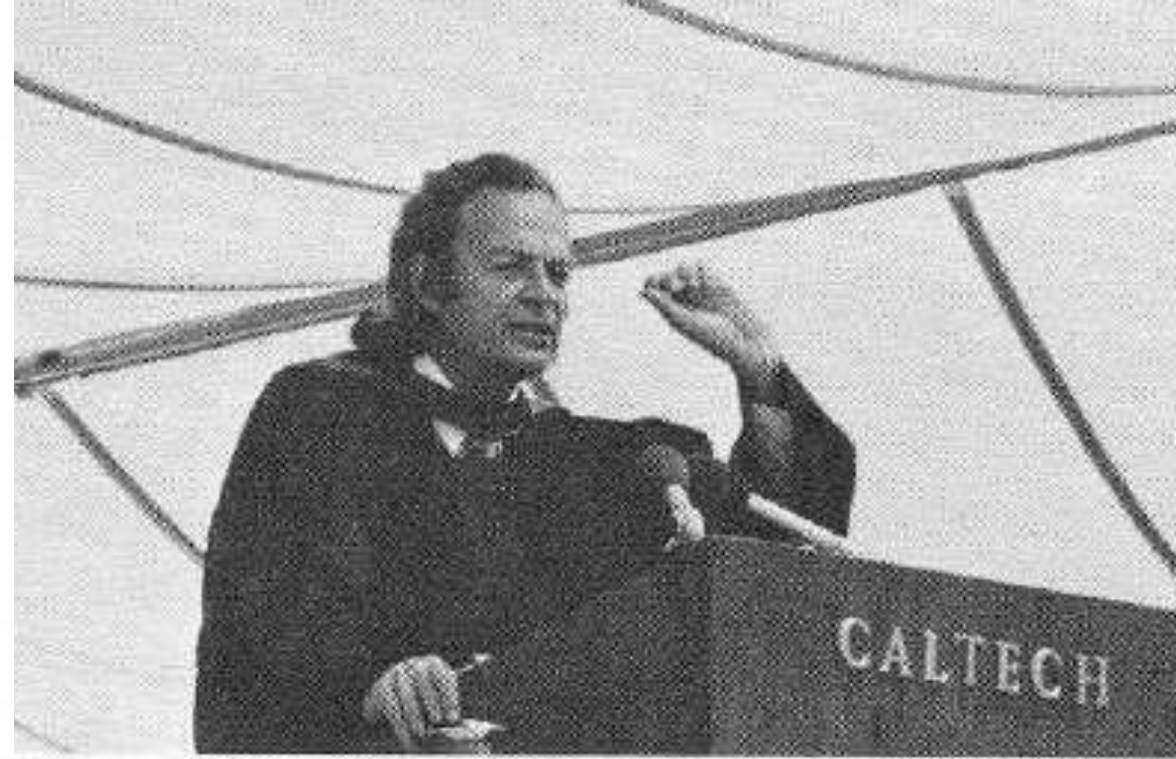
Instead of Organized
Skepticism

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