

Nano-risks, nano-imaginaries, nano-fictions

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29/07/2019

So many men, so few women





The first person to understand nuclear fission;

She did not win the Nobel prize 1944 for chemistry which went to her colleague Otto Hahn



Lise Meitner 1878-1968

Rosalind Elsie Franklin

Her X-ray images led to the discovery of the DNA double helix structure;

Nobel in Medicine 1962 to J. Watson, F. Crick and M. Wilkins;

Franklin should have ideally been awarded a Nobel Prize in Chemistry (according to J. Watson)

Rosalind Elsie Franklin 1920–1958



Eunice Foot (1819–1888)

Meet the woman who first identified the greenhouse effect

Published on 02/09/2016, 5:58pm

Eunice Foote demonstrated the heat-trapping properties of carbon dioxide at a scientific conference in 1856, newly digitised records show

By Megan Darby

Irish physicist John Tyndall is commonly credited with discovering the greenhouse effect, which underpins the science of climate change.

CIRCUMSTANCES

Affecting the Deat of the Sun's gags.

BY MRS. EUNICE FOOTE.

ART. XXXI .- Circumstances affecting the Heat of the by EUNICE FOOTE.

(Read before the American Association, August 23d, 1)

My investigations have had for their object to e different circumstances that affect the thermal actio of light that proceed from the sun. Several results have been obtained.

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First. The action increases with the density of is diminished as it becomes more rarified.

The experiments were made with an air-pump at drical receivers of the same size, about four incl ter and thirty in length. In each were placed two t and the air was exhausted from one and condensed After both had acquired the same temperature they in the sun, side by side, and while the action of t rose to 110° in the condensed tube, it attained on other. I had no means at hand of measuring the d densation or rarefaction.

The observations taken once in two or three min follows:

	Enhanced Tube		1 Oradensed Thi	
	In shade.	In sec.	Is shade,	1 1
and the second second	78	80	75	100
-	76	82	78	1
	80	81	- 80	
-	- 83	- 84	82	
-		83	85	16.2

This circumstance must affect the power of the different places, and contribute to produce their fee the summits of lofty mountains.

Secontily. The action of the sun's rays was found in moist than in dry air.

In one of the receivers the air was saturated with in the other it was dried by the use of chlorid of ca Both were placed in the sun as before and the

follows:

1	Dry Ale.		Damp Air.	
in the second	In which,	Is ees.	I In shade.	1 1
20.00	15	75	75	-
10.75	78	88	1.000	
1.00	82	102	85	1200
	82	104	82	1152
1000	82	105	82	1000
1000	88	108	92	1.00

A jump into nano

An introduction to nano-risks, nanoimaginaries, fiction







Late Lessons from Early Warnings: The case of nanotechnologies Environmental assus report No 22

Late lessons from early warnings: the precautionary principle 1896—2000

2001



European Environment Agency

Late lessons from early warnings: science, precaution, innovation

Summary

155N 1725-9177





Environmental masse report No 22

Late lessons from early warnings: the precautionary principle 1896—2000



2001

https://www.eea.europa.eu/p ublications/environmental_is sue_report_2001_22/Issue_R eport_No_22.pdf/view European Environment Agency (EEA, 2001): Late Lessons from Early Warnings. The Precautionary Principle 1896–2000

14 case studies of how not heeding early warnings led to catastrophe

Asbestos, chlorofluorocarbons, non-ionizing radiation and 'mad cow disease', leading to

 \rightarrow 12 "late lessons"

Late lessons from early warnings: science, precaution, innovation

Summary

2013







https://www.eea.europa.eu/p ublications/late-lessons-2

EEA Report No 1/2013

Late lessons from early warnings: science, precaution, innovation

Summary





European Environment Agency

Chapter 22 Nanotechnology: early lessons from early warnings



Image: Constraint of the state of the s

Categorisation framework for nanomaterials, according to the location of the nanostructure in the material

How many of them are around to consumers? In the EU they are 4,414 (August 18, 2020); see http://www.nanodb.dk they were 2231 in 2016 (almost doubled in four year)

Source: Steffen Foss Hansen, et al, Nanoproducts – what is actually available to European consumers? https://pubs.rsc.org/en/content/articlelanding/2016/EN/C5EN0018 2J#!

- http://www.nanodb.dk
 - Top use in "personal care" "clothing" followed by "sporting goods" "cleaning"
- silver and titanium dioxide the most used NMs,
- not possible to identify NMs 60% of the products dominant route of exposure = dermal
- human and environmental hazard either "high" or "unknown".

Source: Steffen Foss Hansen, et al, Nanoproducts – what is actually available to European consumers? https://pubs.rsc.org/en/content/articlelanding/2016/EN/C5EN00182J#!

Emerging nanoproducts



EEA Report | No 1/20

This is the old Collingridge Dilemma:

Can we control the development of a technology?

Impacts cannot be easily predicted until the technology is developed and taken up...

... But change is difficult when the technology has become entrenched.

Collingridge, D. 1980, The Social Control of Technology (New York: St. Martin's Press; London: Pinter)

No data, no market principle (REACH)



REACH Regulation (2006) to protect human health and the environment.

Incorporates the precautionary principle.

Though present legislation might fail to differentiate between nano-based products and their conventional counterparts.

Toxicity, bioaccumulation and persistence



Nano(eco) toxicity

Analogies of nano particles with ambient ultrafine particles and asbestos.

Ultrafine TiO_2 and Al_2O_3 of 30 and 20 nm, respectively, produce inflammation in rats.

Surface area a better descriptor than mass for the adverse effects.

Toxicity, bioaccumulation and persistence

Both fullerenes and nanotubes are persistent but little is known about bioaccumulation

There are 50,000 possible combinations of single carbon walled nanotubes with potentially different properties; hard to assess toxicity for all.







A comparison between the EEA recommendations made in 2001 and the current [2013] situation for nanotechnology

EEA Report No 1/2013

Late lessons from early warning science, precaution, innovatio



 Acknowledge and respond to ignorance, uncertainty and risk in technology appraisal.



- 2. Provide long-term environmental and health monitoring and research into early warnings.
 - 3. Identify and work to reduce scientific 'blind spots' and knowledge gaps.

Look at "warning signs": materials novel, biopersistent, readily dispersed, bioaccumulative, lead to irreversible action

(analogy, thousands of mesothelioma caused by the inhalation of asbestos dust)



Late lessons from early warnings: science, precaution, innovation





4. Identify and reduce interdisciplinary obstacles to learning.



11. Identify and reduce institutional obstacles to learning and action.

Mind "institutional ignorance", e.g. from disciplinary blinders: "The Environmental Protection Agency constrained by a world view rooted in chemistry"



European Environment Agency

(for nano you need physics, chemistry, computer sciences, health and environmental science…) EEA Report | No 1/2013

ate lessons from early warning science, precaution, inpovation Account for real-world conditions in regulatory appraisal.

8. Ensure use of 'lay' knowledge, as well as specialist expertise.

EEA Report No 1/201

Late lessons from early warnings: science, precaution, innovation

Summar



uropean Environment Agency

 "the future looked a lot like the past with men in grease-stained blue coats […]"

(it is frequently those who make and use a product that have ideas about what is important and what works and what does not)

6. Systematically scrutinize claimed benefits and risks.

9. Account fully for the assumptions and values of different social groups.

Look at pros and cons; if 'pros' do not materialize, or 'cons' later prove significant = public trust can be compromised

(Mad cow disease: disgust of public opinion to learn of cows fed on offal and bodily waste)



Late lessons from early warnings: science, precaution, innovation



7. Evaluate alternative options for meeting needs, and promote robust, diverse and adaptable technologies.



Not because it can be done it should be done

"Move fast and break things. Unless you are breaking stuff, you are not moving fast enough."

-Mark Zuckerberg
10. Maintain regulatory independence of interested parties while retaining an inclusive approach to information and opinion gathering.



12. Avoid 'paralysis by analysis' by acting to reduce potential harm when there are reasonable grounds for concern. Be alert of regulatory capture; exaggerating uncertainty can be used to deflect regulation



Late lessons from early warnings: science, precaution, innovation





"A comparison between the EEA recommendations made in 2001 and the current [2013] situation for nanotechnology shows that stakeholders are doing some things right, but we are still in danger of repeating old, and potentially costly, mistakes" EEA conclusions: doing enough?



The question seems not to be whether we have learnt the lessons, but whether we are applying them effectively enough to prevent nanotechnology being one more future case study on how not to introduce a new technology

Despite a good start, it seems that we have become distracted

Other views and concerns for an ethics of nanotechnologies

Dutch view: RIVM 2014

National Institute for Public Dealth and the Declarament Mining of Health, Wellins and Spen

Assessing health & environmental risks of nanoparticles



Source: E.A.J. Bleeker, S. Evertz, R.E. Geertsma, W.J.G.M. Peijnenburg, J. Westra, S.W.P. Wijnhoven, Assessing health & environmental risks of nanoparticles. Current state of affairs in policy, science and areas of application, RIVM Report 2014– 0157, http://www.rivm.nl/bibliotheek/rapporten/2014–0157.pdf

Summary version: Jaco Westra (editor), 2014, Assessing health and environmental risks of nanoparticles. An overview, RIVM Rapport 2014–0157,https://www.rivm.nl/sites/default/files/2018– 11/007767_nanoparticles_eng-tg.pdf





Spacing of atoms are of the order to 100 picometers = 0.1 nanometres





Source: McDermott, Will and Emery, 2014. 2013 Nanotechnology Patent Literature Review. McDermott, Will and Emery.





Findings: Nanotoxicology developing but unable to cope with existing volumes;

Extending present chemical testing to nanomaterials inadequate;

Need for balancing safety and economic feasibility with innovation; "Safe-by-design?" this concept can too easily be interpreted as balancing risk or hazard and functionality



Policy: in the EU nanotechnology is one of the five KET, Key Enabling Technologies; with microelectronics and nanoelectronics (including semiconductors), photonics, advanced materials, and biotechnology

In the US the National Nanotechnology Initiative Strategic Plan (NSTCCT, 2014)



How to cope: Need for generalized, grouping approaches, such as a nanoparticle-specific QSAR Quantitative Structure Activity Relationship, computer based predictions...

Activities ongoing in Scientific Committee on Consumer Safety (e.g. cosmetics), Scientific Committee of Emerging and Newly Identified Health Risks (e.g. on nano-silver), REACH (TiO₂) and EFSA (food additive) **but legislative gaps exists**.



Concerns

- Consumers not informed;
- No regulatory incentive for manufacturers to make data available;
- Measuring techniques expensive;
- Too many products too quickly compared to pace of risk analyses
- Adaptation of regulators (e.g. REACH) slow and with gaps









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/theethics-of-nanotechnology/ Manufacturing Precision Manufacturing Material Reuse Miniaturization

Medicine

Pharmaceutical Creation Disease Treatment Nanomachine-assisted Surgery Environment Toxin Clean-up Recycling Resource Consumption Reduction





Weapons Miniature Weapons and Explosives Disassemblers for Military Use Rampant Nanomachines Self Replicating Nanomachines The Gray Goo Scenario Surveillance Monitoring Tracking





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

Article:

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

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

Nano for trans-humanism?

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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

https://pubmed.ncbi.nlm.nih.gov/25684379/

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.



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 us people as cogs."



Unlike Feynman, Drexler predicts nanomachines which can reproduce themselves

"As we look forward to se 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')

- Gray 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

Sociotechnical Imaginaries

SHEILA JASANOFF & SANG-HYUN KIM



Sheila Jasanoff

DREAMSCAPES of MODERNITY Sociotechnical Imaginaries and the Fabrication of Power How visions of scientific and technological progress carry with them implicit ideas about public purposes, collective futures, and the common good





Sheila Jasanoff



Ulrich Beck (1944 –2015)

Ulrich Beck Risk Society Towards a New Modernity

\$



The industrial society does not manage the risks it has manufactured

The matter of contention hence is no longer about the 'distribution of goods' but the 'distribution of bads'

Decision move away from policy to the laboratories and industrial power



Chapter 1 On the logic of wealth distribution and risk distribution

Implicit ethics;

- Risk determinations (though clothed in math) are symbiosis of natural and human sciences, of interests and facts, in need of "cooperation across the trenches of disciplines, citizens' groups, factories, administration and policy" … but this may disintegrate into "definitional struggles".



Chapter 7 Science beyond truth and enlightenment

- "The differentiation and complexification of the sciences transforms it into a "self service shops for financially well endowed customers in need of arguments."

 "It is not uncommon for political programs to be decided in advance simply by the choice of what expert representatives are included in the circle of advisers."

→ The technique is never neutral



Ulrich Beck

EVIDENCE. ARGUMENT, & PERSUASION IN THE POLICY PROCESS GIANDOMENICO MAJONE

"The technique is never neutral"

Majone: "In any area of public policy the choice of instruments, far from being a technical exercise that can be safely delegated to the experts, reflects as in a microcosm all the political, moral, and cultural dimensions of policy-making"

Chapter 7 Science beyond truth and enlightenment

- Feudalization of cognitive practices

In developed civilizations, scientific cognitive practice becomes a manipulation of latently political variables

➔ On transforming a political problem into a technical one



(society) Practical problem

translate

interpret

Courtesy of Jeroen van der Sluijs



Technical problem (science)

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



Environmental Science & Policy

Volume 106, April 2020, Pages 87-98



The technique is never neutral. How methodological choices condition the generation of narratives for sustainability

Andrea Saltelli ^{a, b} $\stackrel{\circ}{\sim}$ $\stackrel{\boxtimes}{\sim}$, Lorenzo Benini ^c, Silvio Funtowicz ^a, Mario Giampietro ^{d, e}, Matthias Kaiser ^a, Erik Reinert ^{a, f}, Jeroen P. van der Sluijs ^{a, g, h}





Elijah Millgram: warns against "procedural utopia", a machinery to take the right decision based on a set of logical rules and methods.

A Cartesian dream? Cartesian anxiety EDITED BY ANGELA GUIMARÀES PEREIRA AND SILVIO FUNTOWICZ SCIENCE, PHILOSOPHY AND SUSTAINABILITY THE END OF THE CARTESIAN DREAM

ROUTLEDGE EXPLORATIONS IN SUSTAINABILITY AND GOVERNANCE PATHWAYS TO SUSTAINABILITY

THE POLITICS OF UNCERTAINTY

Challenges of Transformation







Ian Scoones Andy Stirling

Free download https://www.taylorfrancis.com/books /e/9781003023845

A refutation of technological determinism, "modernity and progress as a hard- wired 'one- track' 'race to the future'"



Frank Knight (1921) described very clearly the between risk and uncertainty.

Risk = know outcomes & probabilities Uncertainty = unsure about the probabilities

Yet modernity tends to 'close down' towards risk pretending to know the probabilities





Frank Knight

For Knight profit belongs to the taker of uncertainty

(a contested notion; the Knight&Keynes against Ramsey and De Finetti)

A short reading: https://www.johnkay.com/2012/08/ 15/the-other-multiplier-effector-keyness-view-of-probability/

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 word of ubiquitous nanotechnology (on the tap, as well as airborne) with class, power and technology conflicts; Feynman and Drexler mentioned



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



JARON LANIER

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Note how nano is coupled with the new social media. New social media making us 'worse persons' in a popular book of Jaron Lanier …





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then this would lead to discuss
platform or 'surveillance
capitalism': can human behaviour
be predicted and piloted?



The End

