Silvio Funtowicz, Centre for the Study of the Sciences and the Humanities, University of Bergen,

Prodromes of post-normal science, August 27th-September 1st, 2018, Course Numbers for policy, Castelldefels (Barcelona)

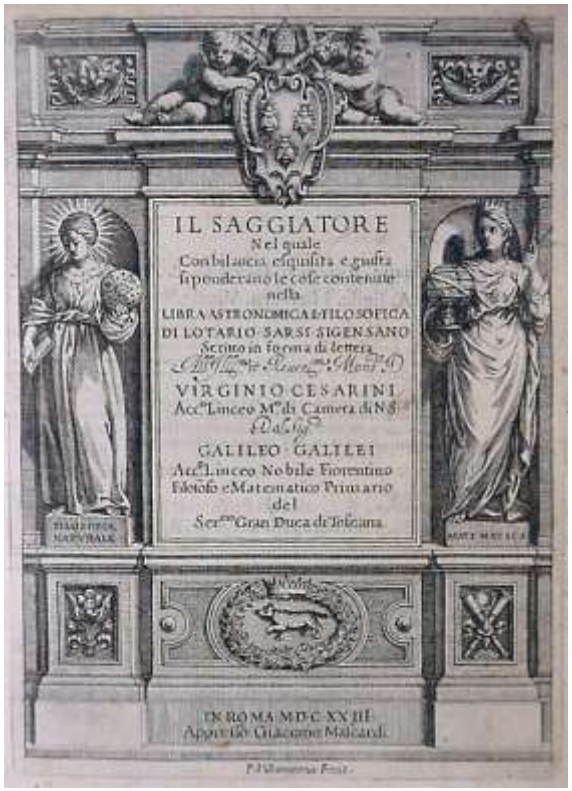
Marie Jean Antoine de Condorcet 1795:
“Sketch for a Historical Picture of the Progress of the Human Mind”

“Will increased welfare and improved health of man lead to largely increased populations? Will not necessarily there be a time when the number of people has outgrown the natural resources that nature can supply? Is it not reasonable to assume that when resources become scarce, then there will be fight for the resources, war between people?

Nobody could claim that such a time is imminent, **Technological progress may bring the answers.**

People’s ethics and morality will progress alongside reason. Our moral duty is not to make sure that unborn life is born, but that those that are born are secured a life in reasonable welfare, dignity and happiness.”

Galileo: primary and secondary qualities



… a piece of paper or a feather, when gently rubbed over any part of our body whatsoever, will in itself act everywhere in an identical way; it will, namely, . But we, should we be touched between the eyes, on the tip of the nose, or under the nostrils, will feel an almost intolerable titillation – while if touched in other places, we will scarcely feel anything at all. Now this titillation is completely ours and not the feather's, so that if the living, sensing body were removed, nothing would remain of the titillation but an empty name. And I believe that many other qualities, such as taste, odour, colour, and so on, often predicated of natural bodies, have a similar and no greater existence than this.

Galileo Galilei (1623): *The Assayer*

Eisenhower's Farewell Address to the Nation January 17, 1961

http://www.informationclearinghouse.info/article5407.htm

Today, the solitary inventor, tinkering in his shop, has been overshadowed by task forces of scientists in laboratories and testing fields. In the same fashion, the free university, historically the fountainhead of free ideas and scientific discovery, has experienced a revolution in the conduct of research. Partly because of the huge costs involved, a government contract becomes virtually a substitute for intellectual curiosity. For every old blackboard there are now hundreds of new electronic computers.

The prospect of domination of the nation's scholars by Federal employment, project allocations, and the power of money is ever present – and is gravely to be regarded. **Yet, in holding scientific research and discovery in respect, as we should, we must also be alert to the equal and opposite danger that public policy could itself become the captive of a scientific-technological elite**.

Weinberg A M. Science and trans-science. *Minerva* 10:209-22, 1972.
[Oak Ridge National Laboratory, TN]

Origins of Science and Trans-Science

Alvin M. Weinberg
Medical Sciences Division
Oak Ridge Associated Universities
Oak Ridge, TN 37831-0117

I c
time Oak Ridge National Laboratory) was becoming involved in the debate over nuclear power—in particular the debate over the hazard of low levels of radiation. The

such [illegible] Brooks suggested that an analysis of such situations was beyond the power of mathematics, and therefore, was trans-scientific.[2]

The term "trans-science" is used quite widely now. Perhaps most notable was W. Ruckelhaus's admission in 1985 that many of the EPA's regulations hang on the answers to questions that can be asked of science but cannot be answered by science—i.e., are trans-scientific.[3]

After the paper was published, Harvey Brooks added another dimension to "trans-science"—the evolution in time of systems governed by large classes of nonlinear equations. Poincaré was one of the first to stress

mits of science. *Proceedings of the Symposium on Phenotypic ssment*, December 7-10, 1986. Brookhaven National Laboratory.

Minerva 10:484-6, 1972.
. *Technol.* I:19-38, 1985.
4. Wagner W G. Trans-science and torts. *Yale Law J.* 9:428-49, 1986.

COLUMN

Hazy reasoning behind clean air

Science alone can't determine how regulations are written, argues **David Goldston**.

Last month, *The Washington Post* reported that President George W. Bush had personally intervened to weaken new regulations to control smog just as they were about to be announced by the Environmental Protection Agency (EPA). In response, advocates of tighter standards predictably charged that the president had overturned a scientific judgement. Carol Browner, who headed the EPA under President Bill Clinton, put the matter starkly, telling the *Post* that the Clean Air Act creates "a moral and ethical commitment that we're going to let the science tell us what to do".

But does it? This conceit that science alone should and can dictate clean-air standards is propagated by political figures of all stripes and often by scientists themselves. Politicians always want to argue that any regulatory measure they are supporti… by science because d… tion sound objective… fray. That's especially… environment, when… on your side may be t… that can reach someo… ideological persuasio…

In reality, thoug… involve policy judg… tific determinations… uncertain. The Clear… decisions to the "judg… tor" of the EPA (a pre… is advised by, among… Contending that stan… science conflates poli… muddying the debat… needlessly in the line…

So what's really at… smog rules? The rul… sets what is known a… for allowable concen… ozone, the main con… the law, the seconda… to "protect the publi… damage to crops, nat… thing else other than… covered by the prima…

The EPA's 24-memb… weighed in on two crit… the secondary standa… should ozone be meas… permissible level of oz… may sound like a techn…

areas turn out to violate the standard because ozone levels can vary significantly within a given day. For example, if being above the allowable unanimously recommended a specific range of ozone standards, a number within that range can hardly be seen as the only justifiable standard under the law. Indeed, the EPA's own science staff had recommended a slightly different range. Critics are free to attack the number chosen by the president, which will keep some rural counties in compliance with clean-air rules. What they cannot legitimately argue is that the president's selection runs counter to the science. The debate is about what kinds of damage harm the public welfare and what kinds of uncertainty can be tolerated as a basis for decision-making.

The debate over the new ozone standards is just beginning, but the detrimental impact of confusing science with policy can be seen by looking back at what happened in 1997, when the EPA last changed the ozone rules. The fight then was over the primary ozone standard, the one designed to protect public health. The EPA proposed tightening the standard, and Browner (then EPA's chief) repeatedly argued that the decision was dictated by the science.

As a congressional staffer, I fought for the EPA proposal and I still support it. But what the sci… …ted was that for a given … a predictable number … sions from aggravated … the time, there was lit… …caused chronic health … refore the policy issue … admissions are accept… …o politician was inter… …debate. The members … isory panel at the time … ndard to suggest, but … was a "policy call", not … science in no way told … do.

…ost in what became a … acrimonious debate … opponents of the new … accused the other of … is was bad for policy … how to decide on an … ction never got raised. … And it was bad for … tions of poor science … e of political goals can … confusion about the …

…even more clearly than … of a policy debate mas… …bate. In such instances, … ripping off the policy… …ing them. ■

…ing lecturer at … nter for the … at … ill.com.

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Hazy reasoning behind clean air **David Goldston,** Nature 452|3, April 2008

'Science alone can't determine how regulations are written'

[…] EPA's science panel found that "quantitative evidence […] must … be characterized as having high uncertainties." What to do in the face of uncertainty is a policy question, not a scientific question. [..] The debate is about […] what kinds of uncertainty can be tolerated as a basis for decision-making.

Industry groups are fighting government regulation by ***fomenting scientific uncertainty***

DOUBT Is Their Product

By David Michaels
Photographs by Mindy Jones

Science American, June 2005, pp. 96

RIO DECLARATION ON ENVIRONMENT AND DEVELOPMENT
Rio de Janeiro, 3-14 June 1992

Principle 15

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

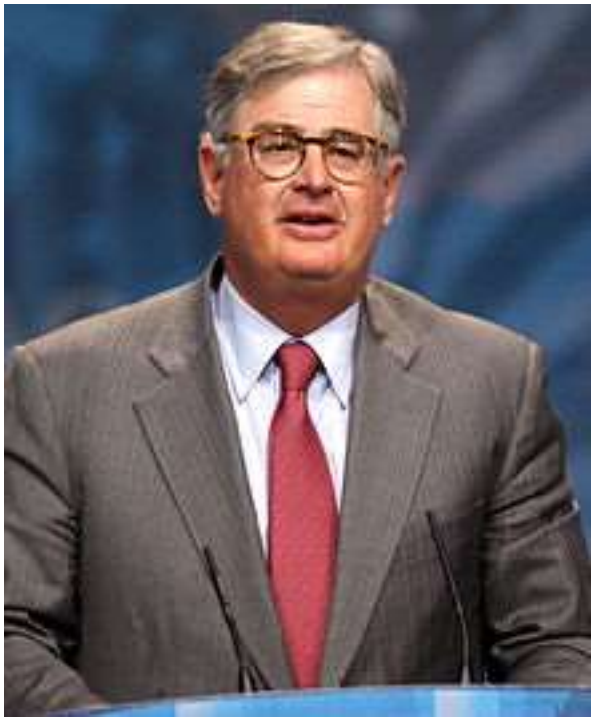
The Scientist Qua Scientist Makes Value Judgments

Richard Rudner

Philosophy of Science, Vol. 20, No. 1 (Jan., 1953), pp. 1-6

…clearly the scientist as scientist does make value judgments. For, since no scientific hypothesis is ever completely verified, in accepting a hypothesis the scientist must make the decision that the evidence is sufficiently strong or that the probability is sufficiently high to warrant the acceptance of the hypothesis. Obviously our decision regarding the evidence and respecting how strong is "strong enough", is going to be a function of the importance, in the typically ethical sense, of making a mistake in accepting or rejecting the hypothesis.

Palmisano, Sam (2010), Welcome to the decade of smart, Royal Institute of International Affairs Chatham House, London, January 12th 2010, http://online.wsj.com/public/resources/documents/palmisano_decadeofsmart-jan12.pdf



Let me leave you with one final observation, culled from our learning over the past year. It is this: Building a smarter planet is realistic precisely because **it is so refreshingly non-ideological.**

Trade treaties centre on science

Proposed deals have potential to boost research, but also to weaken health and environmental protections.

BY DA N I E L C R ESSEY

401-402 | NATURE | VOL 521 | 28 MAY 2015

***NATURE* | EDITORIAL**

The use of sound science to set regulations that affect trade is to be encouraged. But the science is not always unequivocal, and it must by no means be the only consideration. The practices of individual nations are forged from their own history and culture, resulting in different approaches to how they structure health care, agriculture, food or environmental systems — and in how these are shaped by government and th e market, and to what extent. National attitudes to science and technology are formed in a similar way; for example, in the level of risk people are willing to accept, or the ethical limits that such attitudes place on research or medical practices.

Nature **521,** 393 (28 May 2015)