The Sciences of Science Communication

Baruch Fischhoff
Carnegie Mellon University
Department of Social and Decision Sciences
Department of Engineering and Public Policy
http://www.cmu.edu/dietrich/sds/people/faculty/baruch-fischhoff.html

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Some Semi-Ancient History
Carbon Dioxide Effects Research and Assessment Program

Workshop on Environmental and Societal Consequences of a Possible CO2 — Induced Climate Change
The Panel first met at a major interdisciplinary workshop organized by the AAAS at Annapolis, Maryland in April of 1979. Using as a reference a hypothetical scenario of how the climate might change as the result of CO₂ emissions, the panel identified a variety of important issues and research questions pertaining to the nature of possible societal perception of and responses to a climate change. The Panel’s report, published in a DOE document, *Workshop on Environmental and Societal Consequences of a Possible CO₂-Induced Climate Change* (Carbon Dioxide Effects Research and Assessment Program, Report 009, U.S. Department of Energy, CONF-7904143, 1980), emphasized the unusual characteristics of the “CO₂ problem”, including its long-term, slowly developing, and irreversible aspects, and underscored the importance of viewing the problem in the general context of other societal problems and rapid societal change.
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SOCIAL AND INSTITUTIONAL RESPONSES

Elise Boulding, Sociology Department, Dartmouth, Co-Chairman
Stephen H. Schneider, National Center for Atmospheric Research, Boulder, Co-Chairman
Elizabeth Colson, Department of Anthropology, University of California, Berkeley
John G. Corbett, National Center for Atmospheric Research
John Durand, Population Studies Center, University of Pennsylvania
Baruch Fischhoff, Decision Research, Eugene, Oregon
Michael H. Glantz, National Center for Atmospheric Research
Dean E. Mann, Political Science Department, University of California, Santa Barbara
Klaus Meyer-Abich, (AUGE), Universität Essen, West Germany
Thomas H. Moss, Staff Director & Science Advisor, Congressman George E. Brown, Washington
Haraldur Olafsson, Faculty of Social Science, University of Iceland, Reykjavik
John Opie, Department of History, Duquesne University
Robert I. Rotberg, Department of History, Massachusetts Institute of Technology, Cambridge
Howard J. Taubenfeld, Temple University School of Law, Philadelphia
Eric G. Walther, Visibility Research Center, University of Nevada, Las Vegas
Richard Warrick, Graduate School of Geography, Clark University, Worcester
Chris Bernabo, Office of Congressman George Brown, Washington
Robert Chen, Massachusetts Institute of Technology, Cambridge,
Rapporteur
Panel IV Social and Institutional Responses. The CO₂ issue appears to be a gradually developing problem that is so far proceeding too slowly to attract significant public notice. Yet it does have aspects that are linked to other high-priority social problems, including the development of alternative energy systems and certain environmental threats. Uncertainties inhibit precise definition of the social costs and benefits of CO₂-induced climate change. Impacts of climate change will not be distributed uniformly; consequently, the economic and social effects for each region would vary greatly. Prevention of CO₂ build-up is a global matter, but individual nations or other political units could act independently to adapt to changing climates. As scientific research on CO₂ progresses, information regarding the risks and benefits of climate change should be diffused through the hierarchy of social units -- ranging from individuals, families, and communities to nations and international groups. Institutions then will be better able to identify and implement appropriate strategies for dealing with the situation. Because of the varied geophysical, biological, and societal effects that may result from CO₂ build-up, the problem calls for an unprecedented interdisciplinary research effort. The format used in this undertaking can perhaps be applied to other complex social problems as well.
the problem calls for an unprecedented interdisciplinary research effort. The
“Hot Air” Topics

What’s worth knowing?
What are the properties of the information?
How (well) can we convey that evidence?
What is our place in the political process?
What is our place in the politics of science?
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What’s Worth Knowing?

Start with the decisions
Work back to identify the relevant information
Force the sciences to demonstrate their relevance; drive their research agenda
The prospect of CO$_2$-induced climatic change poses a series of interlocking decisions to be made by individuals, groups, national, and international bodies. At each level, people must decide whether the problem is worth attending to and, if so, should efforts be made to prevent the build-up from happening (e.g., by drastically restricting the consumption of fossil fuels), to implement curative schemes (e.g., massive afforestation programs), to adapt to the new world we are creating (e.g., by developing new crops or moving large populations), or to promote the build-up (for those who hope to benefit from the change). Each decision requires an assessment of what is happening, what the possible effects are, and how well one likes them. The quality of these assessments at one level constrains the wisdom of the decisions made at others. Failure of the U.S. to adopt a coherent policy is likely to thwart any international effort. Absence of international cooperation may lead U.S. consumers to feel "why should we drive less when the Brazilians provide tax incentives for logging out the Amazon?" We are all in trouble if the climatologists seriously understate or overstate how much they know. How such assessments are made, by consumers, legislators, diplomats, or scientists, would seem to be eminently psychological questions.
Attitude-Behavior Consistency
(Ajzen-Fishbein conditions)

Use valid, reliable measure
Use multiple items
Measure close in time
Attitudes should match behaviors in terms of
the action performed.
the target of the action.
the context in which the action occurs,
and
the time at which the action occurs.
NRC Committee on Gain-of-Function Research for Pathogens with Pandemic Potential

http://www.nap.edu/catalog.php?record_id=21666
Hot Air Topics

What’s to know?

**What are the properties of the information?**

How (well) can we convey that evidence?

What is our place in the political process?

What is our place in the politics of science?
TABLE 9.1
Nature of the Issues in CO₂-Induced Climatic Change

Properties of the Information
High level of uncertainty
- Critical observations often missing or questionable
- Critical assumptions often unproven
Uncertainty is poorly formulated
- Hard to assess
- Hard to communicate
Subject to distortion in transmission from experts to nonexperts
- Random error added
- Systematic error added
Highly diagnostic information rare and unlikely
Highly technical
Enormous quantity

Properties of Process
Component processes
- Many simple, established causal relations
- Many involve conjecture in the absence of historical or contemporary data
Complex interactions between components
- Understood only through simulation models
- Future may arrive before models with desired sophistication to simulate it can be developed
Hard to assess adequacy of theoretical approximations
Superimposed on poorly understood natural changes and cycles

Properties of Effects
Very low probabilities for many of most interesting
Involve destabilization of entire ecologies
- Secondary and tertiary effects often unidentified (much less measured)
- Resilience of human controls uncertain
Often completely unfamiliar
- Hard to imagine
- Hard to evaluate
Long time span for many
- Until they are felt
- Until they can be undone (if not irreversible)
Benefits and costs distributed at different points in time and to different people
Incommensurable
Characterizing and Communicating Uncertainty in the Assessment of Benefits and Risks of Pharmaceutical Products

Workshop Summary

http://www.nap.edu/catalog.php?record_id=18870
Workshop on Quantification, Communication, and Interpretation of Uncertainty in Simulation and Data Science

http://cra.org/ccc/events/uncertainty-in-computation-workshop/
Communicating scientific uncertainty

Baruch Fischhoff\textsuperscript{a,b,1} and Alex L. Davis\textsuperscript{a}

www.pnas.org/cgi/doi/10.1073/pnas.1317504111
Hot Air Topics

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FDA Risk Communication Advisory Committee

COMMUNICATING RISKS AND BENEFITS: An Evidence-Based User’s Guide

Baruch Fischhoff PhD, Noel T. Brewer PhD, & John S. Downs PhD, editors

http://www.fda.gov/AboutFDA/ReportsManualsForms/Reports/ucm268078.htm
What’s worth knowing?
What are the properties of the information?
How (well) can we convey that evidence?
**What is our role in the political process?**
What is our place in the politics of science?
A less naïve answer to “Why did they ask us?” is that our basic paradigm embodies a political perspective appealing to some. Perhaps we are seen as contributing to a stratification with a technical elite near the top. Maybe experts are frustrated by the refusal of laypeople to believe their analyses, feeling “the public is crazy. Let’s bring in some psychologists to solve this clinical problem.
On the other hand, our interest in facilitating communication with laypeople may cast us as populists concerned with enfranchising and empowering non-experts by increasing their ability to act in their own best interests. Our focus on what people can be taught … may make us a healthy antidote to claims of lay incompetence (the stupid, emotive public).
The Voice of the Patient

A series of reports from the U.S. Food and Drug Administration’s (FDA’s) Patient-Focused Drug Development Initiative

Chronic Fatigue Syndrome and Myalgic Encephalomyelitis

Public Meeting: April 25, 2013
Report Date: September 2013
Hot Air Topics

What’s worth knowing?
What are the properties of the information?
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What is our role in the political process?
What is our place in the politics of science?
Are the natural scientists sufficiently committed to allow their people to work with us or do they maintain the prejudice that interdisciplinary research is the domain of people who cannot cut it in their own fields?
One might ask, “How far will they let us go?” For example, can we work on those topics traditionally in the stranglehold of economics or will our funds be restricted or, more ominously, will we censor our own inquiries to avoid areas in which we are not wanted?
A Model Predicting Key Outcomes

Figure 1. Integrated assessment of MMR-vaccine-associated concepts: solid black arrows indicate links between variables described by experts, dotted black arrows indicate unmediated links mentioned by respondents; links mentioned by experts but not by interviewees are not shown [3].

Downs, J. S., Bruine de Bruin, W., & Fischhoff, B. (2008). Patients’ vaccination comprehension and decisions, Vaccine, 26, 1595-1607
Although we may be invited at the behest of natural scientists and political decision makers, we should not hesitate to tell them how to run at least a part of their business. We probably know some things about the foibles inherent in their modes of analysis that suggest altered approach and reasons for caution.
Our Place in the Politics of Science

We also know something about what the body politic wants to know and how it might respond to various messages. Such information could serve as the basis for manipulating opinion or for making big science more responsive to the public that pays for it. For example, we might tell legislators never to order cost-benefit analyses because it is impossible to provide a clear exposition of their assumptions.
RESEARCH

REVIEW

RISK ASSESSMENT

The realities of risk-cost-benefit analysis

Baruch Fischhoff

http://dx.doi.org/10.1126/science.aaa6516
NRC Committee on Behavioral Science for Intelligence Analysis

Sponsored by the Office of the Director of National Intelligence

Consensus Report

http://www.nap.edu/catalog.php?record_id=13040

Edited Readings

http://www.nap.edu/catalog.php?record_id=13062
How are roles negotiated in communication processes?
What is scientists’ naïve epistemology, for own work and communication science?
How can these engagements improve their science and our own?
Collaboration Seen as Essential

Applied basic science
  -- evaluating accepted science in applied contexts

Basic applied science
  -- pursuing fundamental topics arising in applied contexts

Alan Baddeley
Some Sources

http://www.fda.gov/AboutFDA/ReportsManualsForms/Reports/ucm268078.htm


http://www.hss.cmu.edu/departments/sds/src/src/faculty/fischhoff.php
Carnegie Mellon Electricity Center: http://wpweb2.tepper.cmu.edu/ceic/
Center for Climate and Environmental Decision Making: http://cedm.epp.cmu.edu/index.php
Center for Risk Perception and Communication: http://sds.hss.cmu.edu/risk/
Center for Human Rights Science: http://www.cmu.edu/chrs/
Our Place in the Politics of Science

We might tell climatologists that instead of trying to understand the full picture of what will happen, they should try to produce one clear diagnostic sign that something is really changing in the climate of sufficient magnitude to merit our attention.