

Tools for Expressing Uncertainty: A Window on the Process of Expert Advice

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Why is Expressing Uncertainty Still an Issue?

Tools are available –

But there's no constituency!

Adviser and advisee both have reasons to avoid a frank and precise expression of uncertainty.

This reluctance to confront uncertainty is common to a broad range of professions who must advise a generalist client:

Adviser

Lawyer

Scientist

Risk Assessor

Doctor

Intelligence Agency

Advocacy Group

Engineer

Advisee

Jury

Policy Maker

Decision Maker

Patient

Policy Maker

Public

Business Executive

The Advisee

- Wants to show that (s)he is managing the situation with the help (and the cover) of ‘sound science’
 - And therefore wants to minimize uncertainty OR
- Wants wiggle room
 - To please a constituency,
 - To follow an ideological preference, or
 - To persuade a client
 - And therefore wants to exaggerate uncertainty
- But (s)he doesn’t want to pinned down to a precise estimate of uncertainty

The Adviser

- Is convinced the decision maker wants an answer, not a bunch of alternatives
- The scientist is socialized that in public, an assertion is either a fact or a conjecture.
- An advocate doesn't want minority views to give ammunition to their opponents
- A risk assessor doesn't want the policy maker to run with a minority view
- An intelligence officer doesn't want to 'confuse the client' or have the minority view leaked
- A bureaucracy tends to paper over differences of opinion in order to obtain multi-agency clearance

The CIA has had a scale of uncertainty since the early 1960s – but agents refuse to use it!

It's often easiest for governments to deal with uncertainty avoid being precise about the degree of uncertainty

- Governments may be under strong political pressure to justify actions for which the scientific evidence is at best controversial
 - Trade in genetically modified crops or hormone raised beef
 - Iraq war

**But Avoiding a Frank Discussion of
Uncertainty Can Get You into Trouble.**



The Inter-Governmental Panel on Climate Change (IPCC): Attention to Uncertainty Pays Off

- IPCC Second Assessment (1996) Ducks Frank Treatment of Uncertainty:
 - Statements of the form:
‘Global warming could be between 1.0-3.5C’
 - Opponents attack and exaggerate uncertainty
 - Public doubt builds and is nourished by climate skeptics
- Later editors (The ‘Uncertainty Police’) insist that uncertainty be expressed explicitly.
- The IPCC Fourth Assessment (2007) refers to 90% probability that global warming is due to human action. This appeared in newspaper headlines and buttressed public statements by scientists and politicians that the scientific debate is over. Dealing explicitly with uncertainty paid off.

Here's the Six-Level IPCC Scale of Subjective Uncertainty (Frequentist statistics being unavailable)

- >99%: “Virtually certain”
- 90-99%: “Very Likely”
- 67-90% “Likely”
- 33-67%: “Medium Likelihood”
- 1-33%: “Unlikely”
- <1%: “Very Unlikely”

A Qualitative Scale May Also be Useful as a Complement to the IPCC Scale

- Some clients can't handle numbers
- Conjunctive problem for multi-component risks: $A \rightarrow B \rightarrow C \rightarrow D$
- But don't use vague words – 'anchor' the scale in familiar situations

The standard of proof is a statement of the level of uncertainty tolerable in a given legal situation. It reflects a balance of values.

- **Beyond a reasonable doubt: criminal trial**
- **Clear and convincing evidence: quasi-criminal proceeding (e.g., Unfit parent)**
- **Preponderance of evidence: civil trial**
- **Reasonable belief: arrest or arraignment**
- **Reasonable, articulable suspicion: stop and frisk**
- **Hunch or conjecture: no stop and frisk**
- **(Certain and impossible aren't on the list.)**

[See handouts for comparison of scales]



In principle, one should be able to use these scales to distinguish

- Disagreements over the most likely facts
FROM
- Disagreements over the uncertainty associated with these facts
- AND to inform clients about the range of expert opinion regarding both facts and uncertainties

Most Science Policy Issues (Like Global Warming) Involve 'Post-Modern Science'

- Decision makers and their advisers must cope with uncertainty -- including scientific uncertainty and disagreements among experts
- High profile – public is strongly involved
- Major conflict of values
- Mix of knowledge and ignorance – decisions must be made before all the facts are in and before the situation is well understood
- Scientific advice therefore frames public debate rather than settling it.
- For such issues, a frank treatment of uncertainty is critical to public understanding.

The Precaution 'Principle'

- **'Weak' Formulation:** "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."
 - Rio Declaration on Environment and Development, 1992. (Note triple negative.)
- **'Strong' Formulation:** "When an activity raises threats of harm to human health or the environment, precautionary measures *should be taken* [author's italics] even if cause and effect relationships are not fully established scientifically . . . The *proponent of the activity*, rather than the public, *should bear the burden of proof* [author's italics]."
 - Wingspread Declaration

Stripped of its political context, the Precaution Principle is a statement that one should accept costs and forego benefits, in order to avoid risks when the facts are uncertain.

How much cost are you to accept? How many benefits are you to forego? At what level of uncertainty? How big a risk must you be trying to avoid? The principle doesn't say.

Your attitude toward risks and benefits will determine the answers to these questions:
Are you a technological optimist? An environmental pessimist? In between?

For this purpose, a scale of uncertainty makes possible a display that can facilitate a clear discussion of points of difference on issues such as genetically modified organisms, endocrine disruptors and climate change. [See handout]

It Facilitates Precision re
Estimate of Risk and
Willingness to Pay for
Precautionary Action

Here again, there are many political factors that discourage such a straightforward discussion – but useful tools are available.



Risk assessors might consider developing an agreed standard vocabulary or scale of uncertainty. This would at the same time facilitate clear discussion and create the expectation that it would take place.



***I look forward to your questions
and comments.***



As an Analytic Statement, the Precaution Principle has Many Flaws

- Considers risks but not benefits
- Doesn't consider risks of status quo
- Limited guidance about what to do in a given situation (although restatements are improvements)
- No standard of proof for evidence
- Some formulations do not consider level of damage vs. costs of mitigation or prevention

You Can't Strip out the Political Context

- For environmentalists, Precaution is a statement of distrust and a weapon against the presumed preference for development projects – but also a stimulus to creative measures to avoid 'train wrecks.'