Decisions under Strict Uncertainty: Whither Responsibility?

Roger Strand

Prof., Director, Centre for the Study of the Sciences and the Humanities

University of Bergen, Norway

SVT

A few philosophical reflections...

- ... loosely building upon
  - R. Strand (2002): “Complexity, Ideology and Governance,” *Emergence*, 4:164-183.
  - S. Funtowicz & R. Strand (2007): “Models of Science and Policy”, in Traavik, T. and Lim, L.C. (eds.) *Biosafety First: Holistic Approaches to Risk and Uncertainty in Genetic Engineering and Genetically Modified Organisms*, Trondheim: Tapir, pp 263-278.
  - K. Rommetveit, S. Funtowicz & R. Strand (2010): “Knowledge, democracy and action in response to climate change”, in: R. Bhaskar *et al.*: *Interdisciplinarity and Climate Change*. Abingdon: Routledge, pp. 149-163.
  - S. Funtowicz & R. Strand (2010): “Cambio y compromiso”, *Argumentos de razón técnica*, 13: forthcoming.
- ... loosely commenting upon the workshop contributions made by Marion Fourcade, Jessica O’Reilly, Erik Millstone and James Hammitt

A few philosophical reflections...

- ... assuming that
  - Ulrich Beck was right: Practices and institutions in modern societies produce and distribute unintended and unforeseen “risks” and harms in addition to benefits, and
  - Millstone is right: the Red Book Model is (*sometimes? often?*) in trouble because scientific facts are neither certain nor value-free
- ... asking: Should we try to develop new conceptual, normative models of the relationship between science and policy in difficult public decisions? New expectations? New ambitions and attitudes?
  - Millstone: the co-dynamic model
  - Silvio Funtowicz & Jerome Ravetz: the co-production / post-normal science model
  - The problem of collective agency in global issues

A few philosophical reflections...

- ... focussing upon the role of (sound) science to provide (philosophical) legitimacy and secure rationality
- ... mainly emerging from an interest in
  - governance of novel technologies (bio, nano, ICT, converging)
  - the global climate change issue

Uncertainty and environmental learning

Reconceiving science and policy in the preventive paradigm

Brian Wynne

The author considers the implications for current assumptions about scientific knowledge and environmental policy raised by the preventive approach and the associated Precautionary Principle. He offers a critical examination of approaches to characterizing different kinds of uncertainty in policy knowledge, especially in relation to decision making upstream from environmental effects. Via the key dimension of unrecognized indeterminacy in scientific knowledge, the author argues that shifting the normative principles applied to policy use of science is not merely an external shift in relation to the same body of 'natural' knowledge, but also involves the possible reshaping of the 'natural' knowledge itself.

Dr Wynne is Research Director of The Centre for the Study of Environmental Change, Lancaster University, Lancaster LA1 4YN, UK.

This paper was originally prepared for a conference in April 1991 on 'The Principles of Clean Production', organized for the Stockholm Environment Institute by Lancaster University's Centre for Science Studies and Science Policy. The paper has benefited from criticisms and encouragements from Robin Grove-White, Jane Hunt, Tim Jackson, Les Levidov, and an anonymous referee. The work is supported by the UK Economic and Social Research Council and the Stockholm Environment Institute. No-one but the author bears responsibility for the product.

One of the most important new goals of environmental and technology policies in the last decade has been the shift towards prevention. This change implies acceptance of the inherent limitations of the anticipatory knowledge on which decisions about environmental discharges are based. We can often find out only when it is too late, or at the very least, awesomely expensive, to clean up.

However, while the preventive paradigm is acknowledged in principle, its practice is extremely tenuous, not least because we cannot know definitively what is an adequate level of investment in technological or social change to prevent environmental harm. The preventive approach requires attention to be shifted, from 'end-of-pipe' to 'upstream' decisions about industrial processes, product-design, and R&D strategies. Inevitably, this means finding criteria to determine decisions affecting environmental loads, at a point much further removed than conventional pollution control is from the point of immediate environmental discharge, thus from the point(s) of identification of environmental effects.

The usual technical approach to clean production poses the general question, how can we improve the efficiency of industrial processes in terms of resource use and waste outputs? A more difficult broader question is whether environmentally sustainable futures are feasible even if we assume the most efficient systems of production to be universally in place tomorrow. Might not growing consumption and production simply swallow up the advances provided by those imagined technical utopias? It is striking how effectively environmental policy discourses manage to insulate the technical focus on clean production from the equally material social dimensions of ever-increasing resource-use and waste (including discarded product) output.

How do we provide authoritative knowledge for defining how far we need to enforce greater process efficiency and product-redesign (in both resource-use and waste-outputs), let alone control the cultural processes

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B. Wynne (1992), *Global Environmental Change*, 2:111-127.

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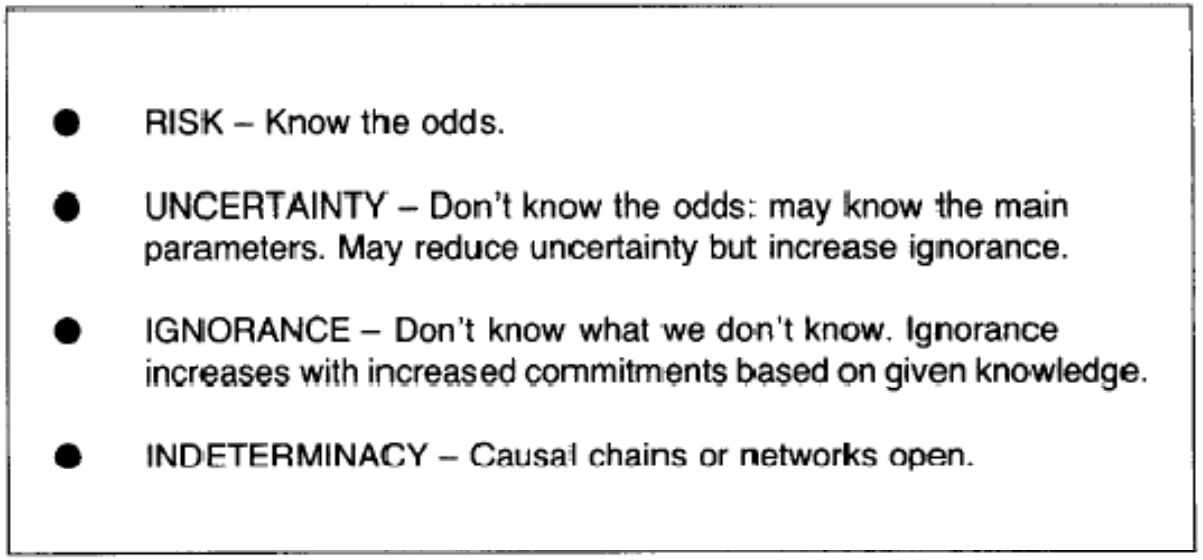

Figure 1. Different kinds of uncertainty.

Change, Lancaster University, Lancaster LA1 4YN, UK.

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Risk and strict uncertainty

- Uncertainty as “risk”: when we know (can quantify) the probabilities
- “(Strict) uncertainty”: the event space is known, but the probabilities cannot* be estimated

- Frank Knight (1921): *Risk, Uncertainty and Profit*
  - There can be no stock market without strict uncertainty

Philosophy = the art of asking stupid questions?

- Why does science play a role in public decision-making?
  - "Why" as a historical question → consult historians, sociologists, STS scholars
  - "Why" = "what are the good reasons for"
    - Science carries authority in our society.
      - Why? (what are the good reason for...)
        - Alt. 1: Science is a neutral and expedient third party
        - Alt. 2: Science provides facts, knowledge

Why involve science in public decisions?

- Alt. 1: Science is a neutral and expedient third party
  - Sometimes false (e.g. novel technologies)
  - Sometimes doubted (e.g. climate issue)
  - Sometimes irrelevant (e.g. human rights)
  - Sometimes insufficient (e.g. financial crisis)
- Alt. 2: Science provides facts, knowledge
  - What is a fact? What counts as knowledge?
  - What counts as facts/knowledge of *sufficient quality?*

Facts of sufficient quality

- Certainty? (Descartes: *I think, therefore I am*)
- Probabilities
  - Pascal and the Jesuite solution
  - The plausibility of signs that are often seen (cf Ian Hacking)
  - The orthodox concept: Probability = Frequency

- Frequencies may not exist
  - Climate, novel technologies: “Will we enter a dramatically new situation if we do this?”
- Subjective probabilities / degrees of belief
  - Problem: When should degrees of belief carry authority?
    - Whose degrees on belief?
    - Funtowicz & Ravetz: *Who judges on quality?*

Who judges on quality?

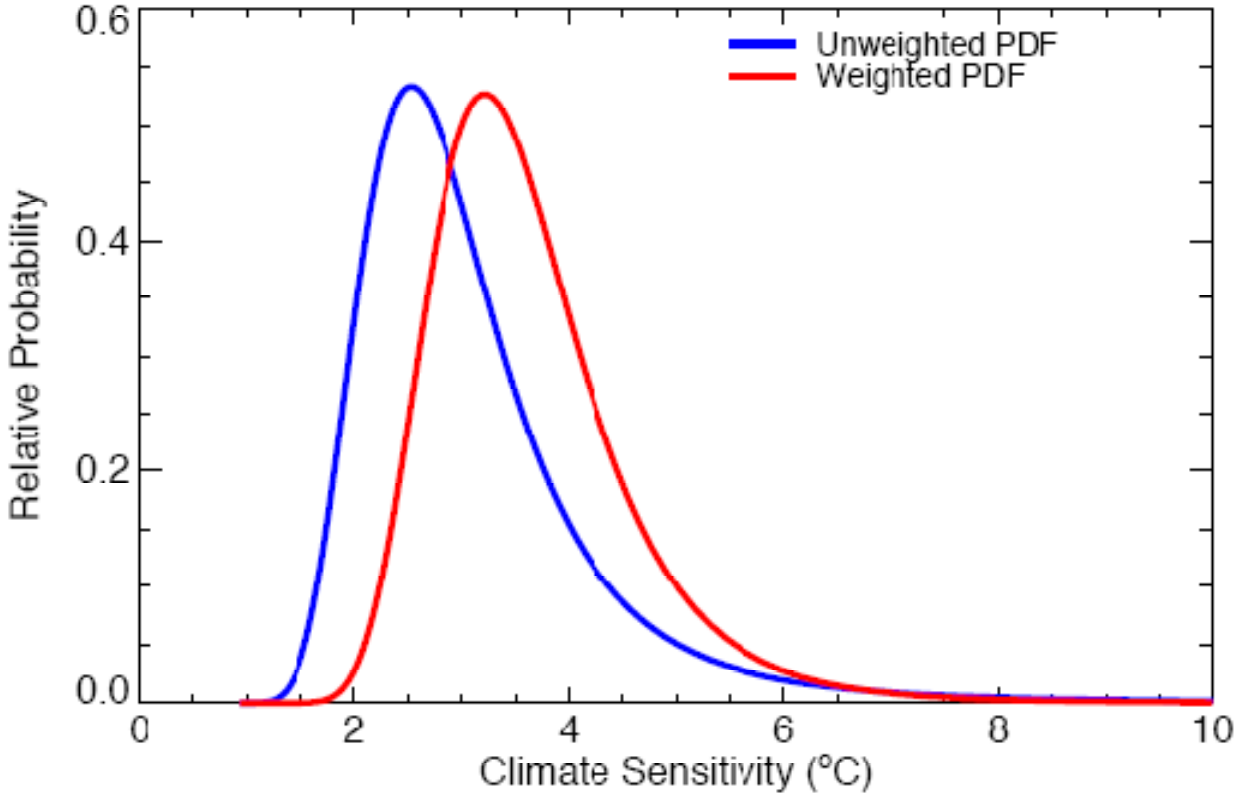
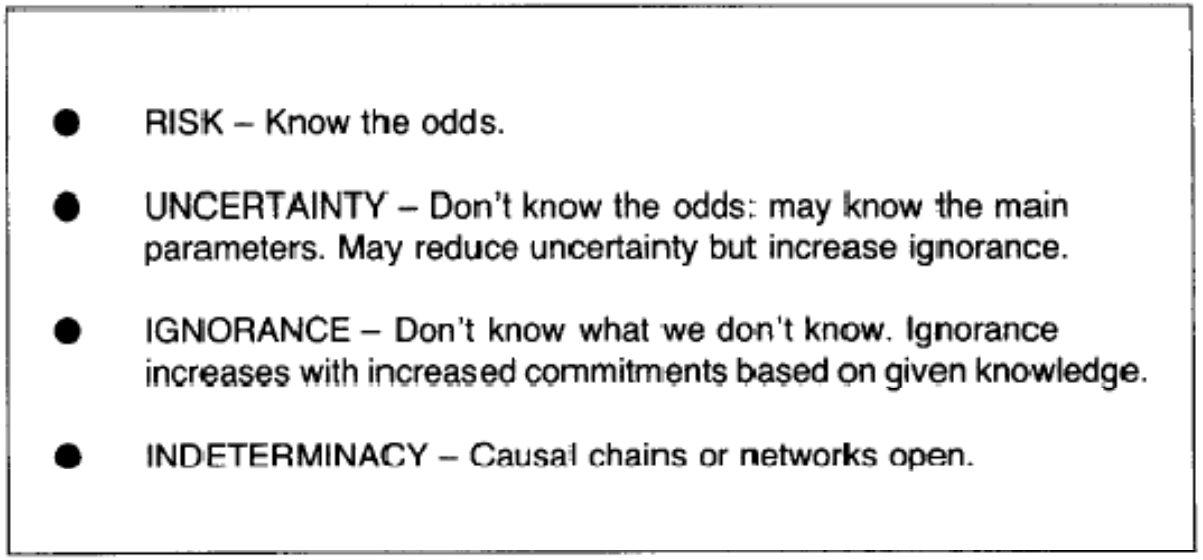


Figure 3-6. Examples of probability distribution functions for climate sensitivity (warming caused by a doubling of CO_2 concentrations). The blue curve shows results from an ensemble of model runs spanning ranges of parameters judged to be plausible by a group of experts, the red curve shows results based on weighting members of this ensemble according to their ability to reproduce metrics of observed climate. From Murphy *et al.* 2004.

Uncertainty and environmental learning

Reconceiving science and policy in the preventive paradigm



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Indeterminacy

- Causal chains or networks are open
- Different system definition → different
  - sources of risks
  - sources of uncertainties
  - border with ignorance

- Trade-offs: narrowing the problem may decrease uncertainty at the expense of ignorance

A whole motley of problems

- Hammett: All probabilities are subjective
- O'Reilly: The uncertainty increased as research progressed
- Fourcade: Values have their own uncertainties and indeterminacies
- Millstone: Scientific expertise cannot legitimate the choice of up-stream assumptions

The problems are bugs, the solutions are patches.

- Hammett: All probabilities are subjective
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- Develop robust Bayesian approaches
- Fund more research and finally uncertainty will be eliminated
- Improve contingent valuation or internalize more values into the market
- Harmonize up-stream assumptions (Weber/Durkheim model OR public deficit model)

Or: the problems are anomalies, the patches drive us further towards crisis

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What's the alternative to "desperate optimism"?

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A few philosophical reflections...

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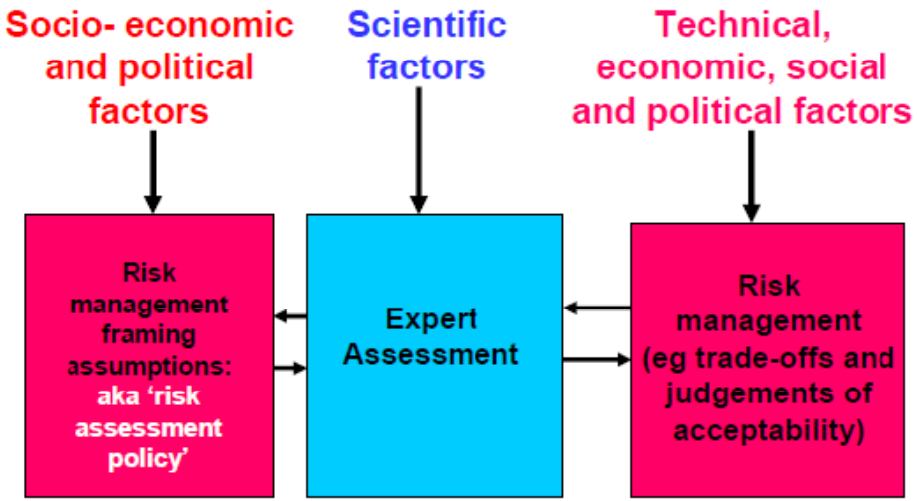
(Terminological overlap)

- Millstone:
- Weber/Durkheim model
- Technocratic model
- Red Book model
- Co-Dynamic model

- Funtowicz/Ravetz/Strand:
- Framing model
- Modern model / demarcation model
- Precautionary model
- Post-normal/co-production model

Millstone: the co-dynamic model

Figure 4 - the co-dynamic model:
reciprocal links between **science** and **policy**



- Lifted from Erik Millstone's workshop paper *The evolution of risk assessment paradigms: in theory and in practice.*

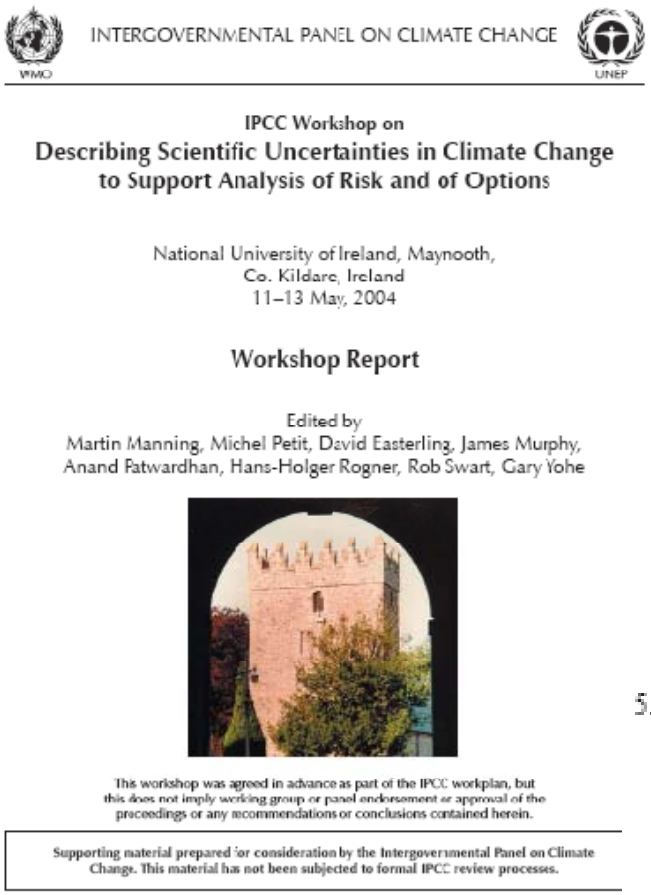
- **Normal Science (Kuhn)**
- .. takes time
- .. replaces ignorance and uncertainty with certainty
- .. focuses on simple and idealized systems
- .. is puzzle-solving
- .. in a paradigm of agreed methods and shared values

- **Post-Normal Problems**
- .. call for urgent decisions
- .. may have irreducible uncertainties
- .. in complex systems (non-linear; nature-culture)
- .. stakes are high
- .. both facts and values may be disputed

The Post-Normal Science Idea

- **Post-Normal Problems**
- .. call for urgent decisions
- .. may have irreducible uncertainties
- .. in complex systems (non-linear; nature-culture)
- .. stakes are high
- .. both facts and values may be disputed

- **Post-Normal Science**
- .. Go for *quality*, not *truth*
- .. Communicate and manage the uncertainties
- .. Include a multitude of perspectives
- .. Extend the peer communities
- .. In general, acknowledge uncertainty, complexity and value-ladenness



INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

IPCC Workshop on
Describing Scientific Uncertainties in Climate Change to Support Analysis of Risk and of Options

National University of Ireland, Maynooth,
Co. Kildare, Ireland
11–13 May, 2004

Workshop Report

Edited by
Martin Manning, Michel Petit, David Easterling, James Murphy, Anand Patwardhan, Hans-Holger Rogner, Rob Swart, Gary Yohe

This workshop was agreed in advance as part of the IPCC workplan, but this does not imply working group or panel endorsement or approval of the proceedings or any recommendations or conclusions contained herein.

Supporting material prepared for consideration by the Intergovernmental Panel on Climate Change. This material has not been subjected to formal IPCC review processes.

- *Incomplete/imperfect observations*
- *Incomplete conceptual frameworks*
- *Inaccurate prescriptions of known processes (poor parameterisations etc)*
- *Chaos*
- *Lack of predictability*

5. *Lack of predictability.* Lack of predictability applies more broadly and can be extended to socio-economic studies where some aspects of societal behaviour are much less amenable to prediction than others. For example, in considering the rate at which new technology may affect energy systems, attempts are being made to separate uncertainty in the rates of market penetration of new technologies from the less predictable rate of invention of new technologies (Nakicenovic, private communication 2003). A widely used approach

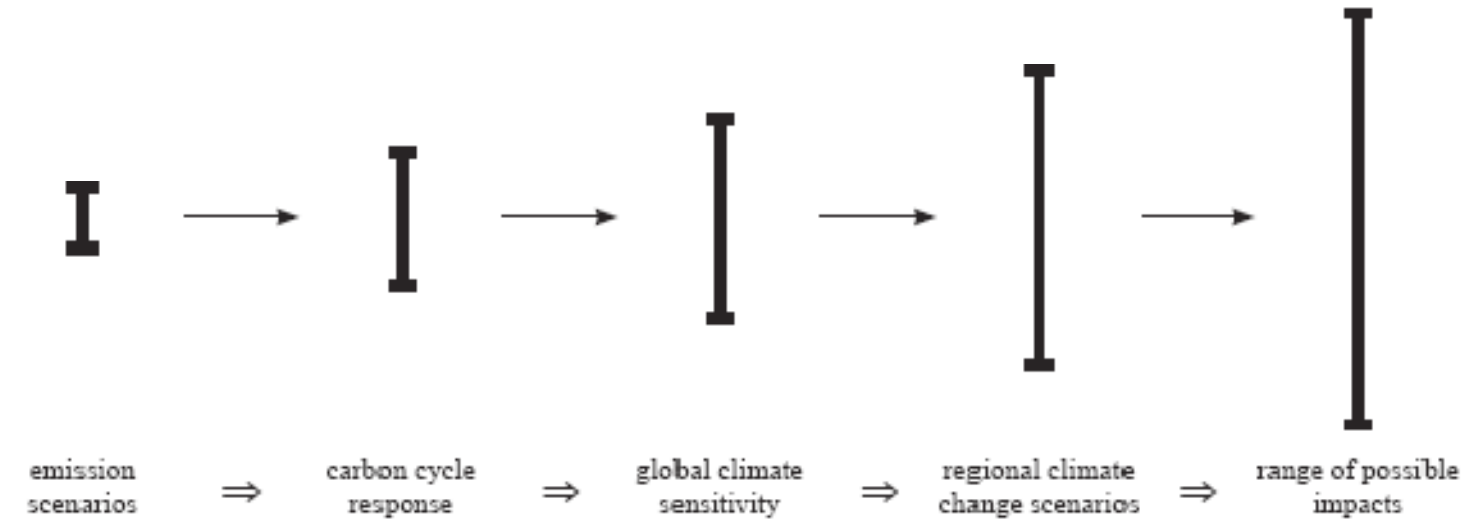


Figure 3-1. Cascade of uncertainties in the relationship between emissions and impacts.

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IPCC assessments support a wide range of users and simple characterization of the audience is not practical, however, public and private sector decision makers are key users. Such decision makers adopt approaches to problems which are different to those in the scientific community. For example, science focuses on testing hypotheses to high levels of confidence rather than on setting a time frame for results. Decision makers on the other hand are often familiar with a requirement to act with "best estimates" that are available within a time table and accept that these have a degree of uncertainty. In addition, decision makers are often interested in complex questions which require aggregation of information from several different scientific disciplines or studies.

In this context it has been argued that the role of a climate change assessment is to distinguish between:

- Known: summarize present knowledge;
- Unknown: describe research needed to improve that knowledge
- Unknowable: summarize what we are unlikely to be able to know before the changes actually occur.

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"Whither responsibility?"

COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 07/02/2008
C(2008) 424 final

COMMISSION RECOMMENDATION

of 07/02/2008

on a code of conduct for responsible nanosciences and nanotechnologies research

3.1 Meaning

N&N research activities should be comprehensible to the public. They should respect fundamental rights and be conducted in the interest of the well-being of individuals and society in their design, implementation, dissemination and use.

3.2 Sustainability

N&N research activities should be safe, ethical and contribute to sustainable development serving the sustainability objectives of the Community as well as contributing to the United Nations' Millennium Development Goals[11]. They should not harm or create a biological, physical or moral threat to people, animals, plants or the environment, at present or in the future.

3.3 Precaution

N&N research activities should be conducted in accordance with the precautionary principle, anticipating potential environmental, health and safety impacts of N&N outcomes and taking due precautions, proportional to the level of protection, while encouraging progress for the benefit of society and the environment.

3.4 Inclusiveness

Governance of N&N research activities should be guided by the principles of openness to all stakeholders, transparency and respect for the legitimate right of access to information. It should allow the participation in decision-making processes of all stakeholders involved in or concerned by N&N research activities.

"Whither responsibility?"

- It seems that there are no responsible nanosciences and nanotechnologies.

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"Whither responsibility?"

- It seems that the authority of science cannot alone justify the collective agency called for in the climate issue

...So what is it that is new today? What is new is that doubt has been eliminated. The report of the Intergovernmental Panel on Climate Change is clear. And so is the Stern report.

It is irresponsible, reckless and deeply immoral to question the seriousness of the situation.

The time for diagnosis is over. Now it is time to act.

(from Gro Harlem Brundtland's speech at the UN Commission on Sustainable Development, 2007)

"Whither responsibility?"

- It seems that the authority of science cannot alone justify the collective agency called for in the climate issue
  - unless doubt and questioning is policed against

- It seems that the truthful message to from the (scientific and political) elite would be
  - we are not in control
  - the Red Book model appears to be part of the problem
  - we do not have the solution for you
  - things might get really bad
  - we propose to stay committed to certain values even if it gets bad
  - it is a mutual challenge to work out how