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SPRU – Science & Technology Policy Research



# Perception, precaution and participation:

reconciling science and society  
in progress of agricultural biotechnology

presentation to conference of European Molecular Biology Organisation  
on '*Food, sustainability and plant science - a global challenge*',  
European Molecular Biology Laboratory, Heidelberg, 17<sup>th</sup> November 2009

**Andy Stirling**

SPRU – science and technology policy research

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# Perception, precaution and participation:

reconciling science and society  
in progress of agricultural biotechnology

- **precaution and perception**
- **problems of ‘sound science’**
- **the multiple faces of incertitude**
- **the plural directions of progress**
- **‘broadening out’ and ‘opening up’ progress in biotechnology**

**Andy Stirling**

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# The Challenge of Precaution

“ ... 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 ”

*Principle 15, 1992 Rio Declaration*

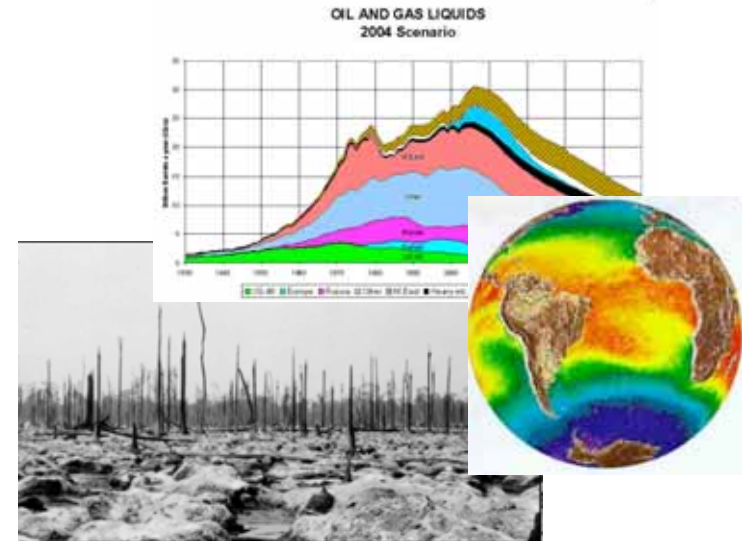
Ambiguous as a ‘science based’ ‘decision rule’

*threat? seriousness? irreversibility? full scientific certainty? cost-effective?*

Prompts unfavourable comparison with ‘sound scientific’ approaches

*(eg: risk, cost-benefit, decision, life cycle, environment impact analysis)*

Major international political tensions: Kyoto, WTO, GM, Chemicals



# 'Sound Science' in Risk Policy

Technology 'choice' continues to be justified by science...

on genetic modification:

*"... this government's approach is to make decisions ... on the basis of **sound science**"*

*former UK Prime Minister, Tony Blair*

on chemicals:

*" ...**sound science** will be the basis of the Commission's legislative proposal..."*

*- EC RTD Commissioner, Philippe Busquin*

on energy:

*"[n]ow is the right time for a cool-headed, evidence based assessment of the options open to us ... I want to sweep away **historic prejudice** and put in its place **evidence and science**"*

*UK Energy Minister Malcolm Wicks*

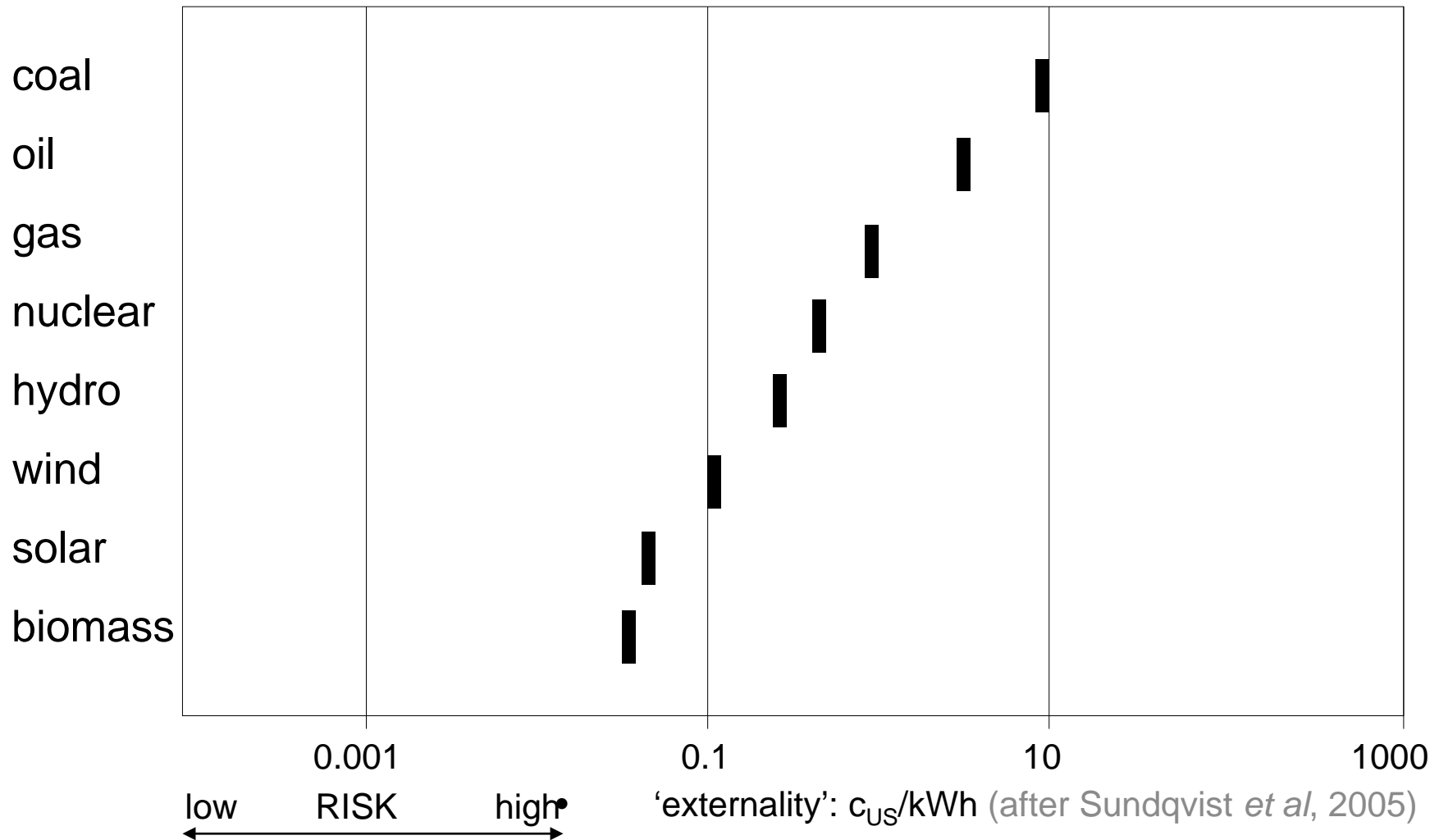


**Treats choice of technology as determined by science**

# eg: Energy

(the apogee of comparative risk & CBA)

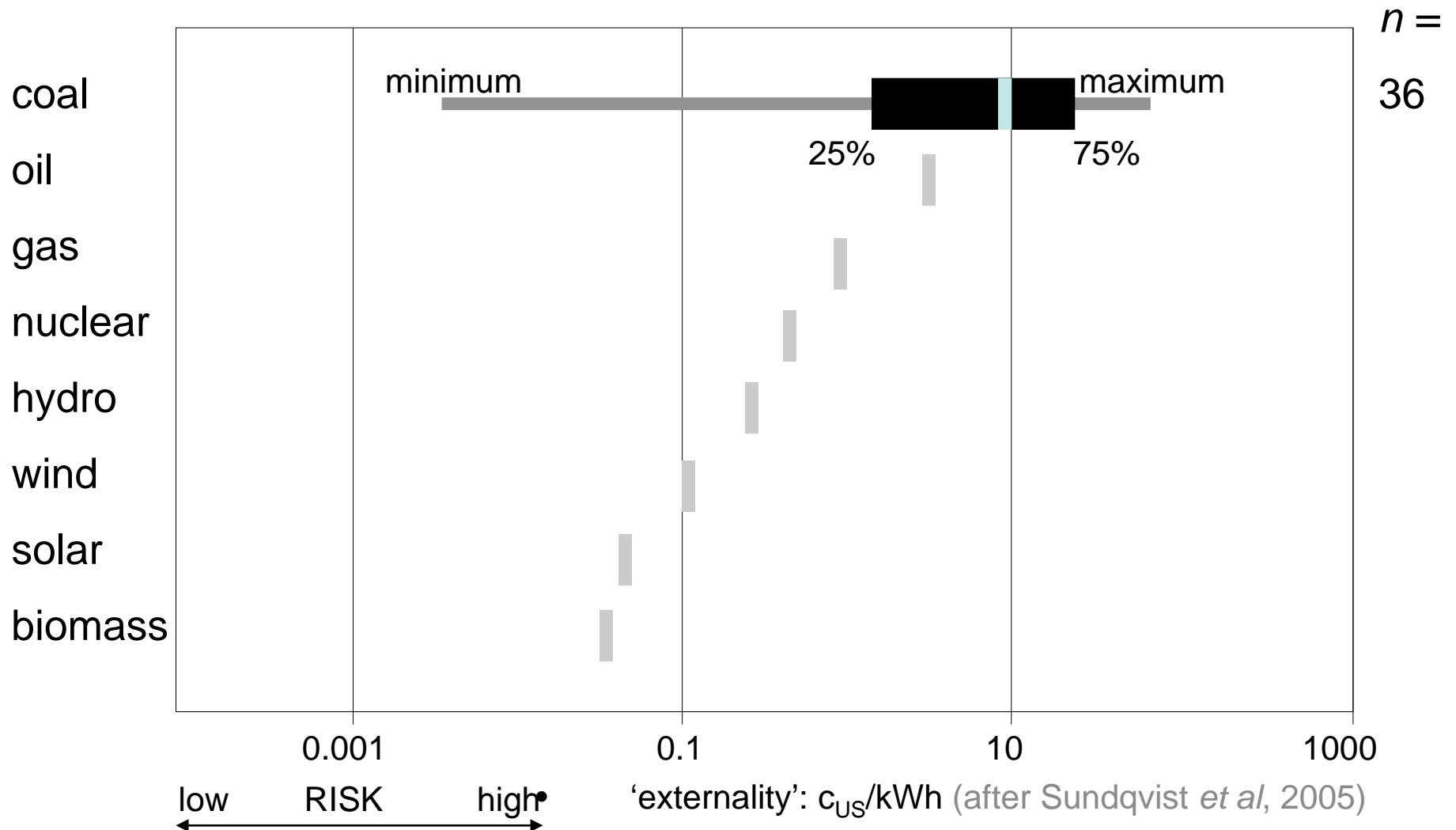
‘Science based evidence’ appears precise



# eg: Energy

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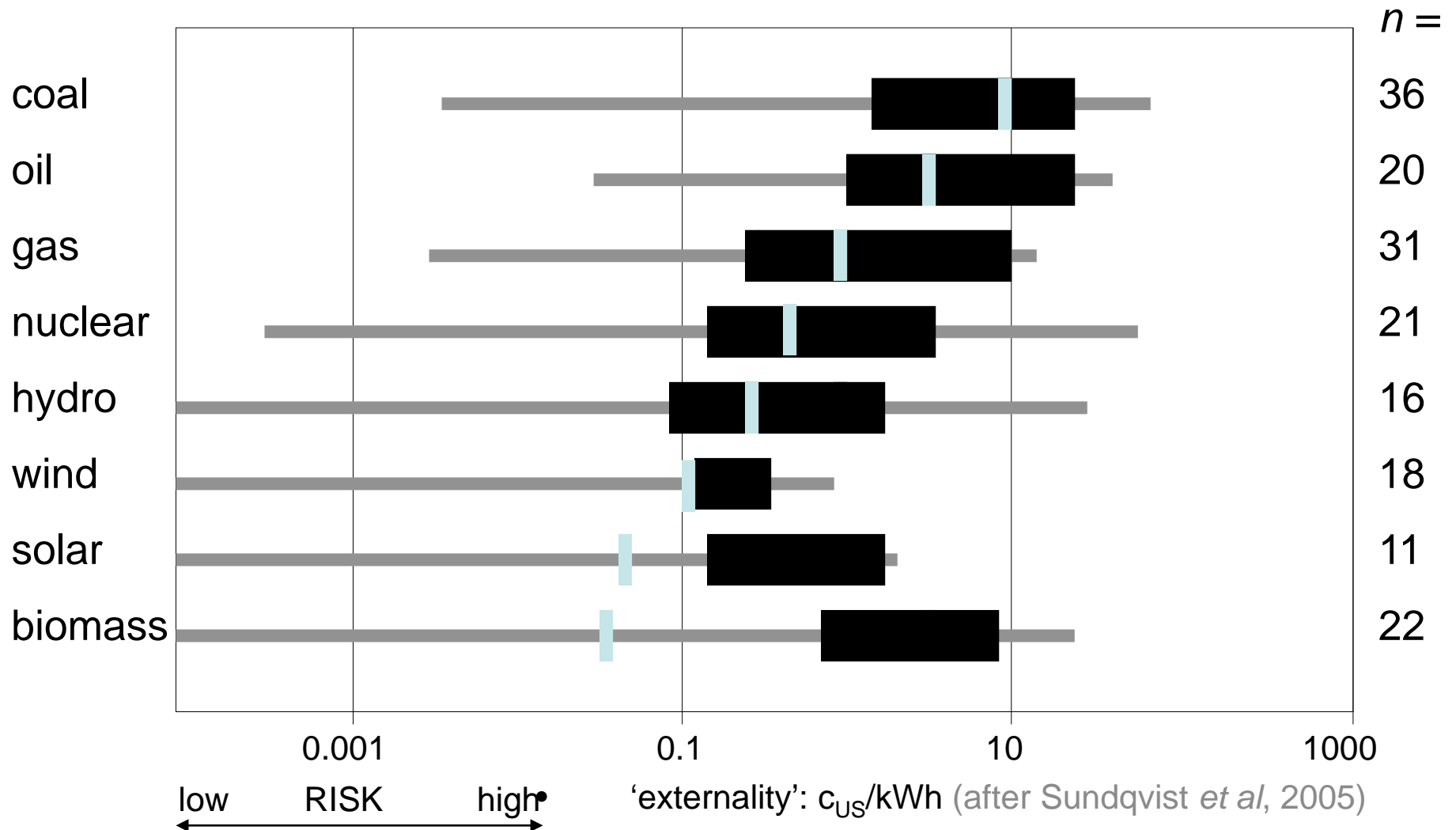
‘Science based evidence’ appears precise, but is sensitive to ‘framing’



# eg: Energy

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‘Science based evidence’ appears precise, but is sensitive to ‘framing’



**eg: Energy**

**(the apogee of comparative risk & CBA)**

**Risks and benefits of different agricultural strategies**

elicited using multicriteria mapping method in Unilever-sponsored research (2003)

# eg: GM Crops (judgments by expert scientific advisers)

## Risks and benefits of different agricultural strategies

elicited using multicriteria mapping method in Unilever-sponsored research (2003)

- organic
- environmental
- intensive
- GM + labelling
- GM + monitoring
- GM + voluntary controls



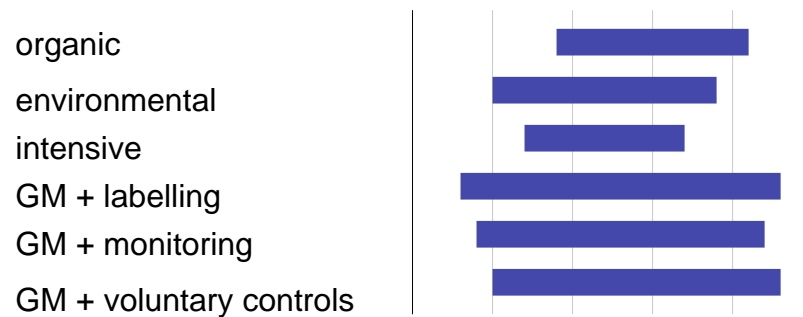
# eg: GM Crops

(judgments by expert scientific advisers)

## Risks and benefits of different agricultural strategies

elicited using multicriteria mapping method in Unilever-sponsored research (2003)

### GOVERNMENT



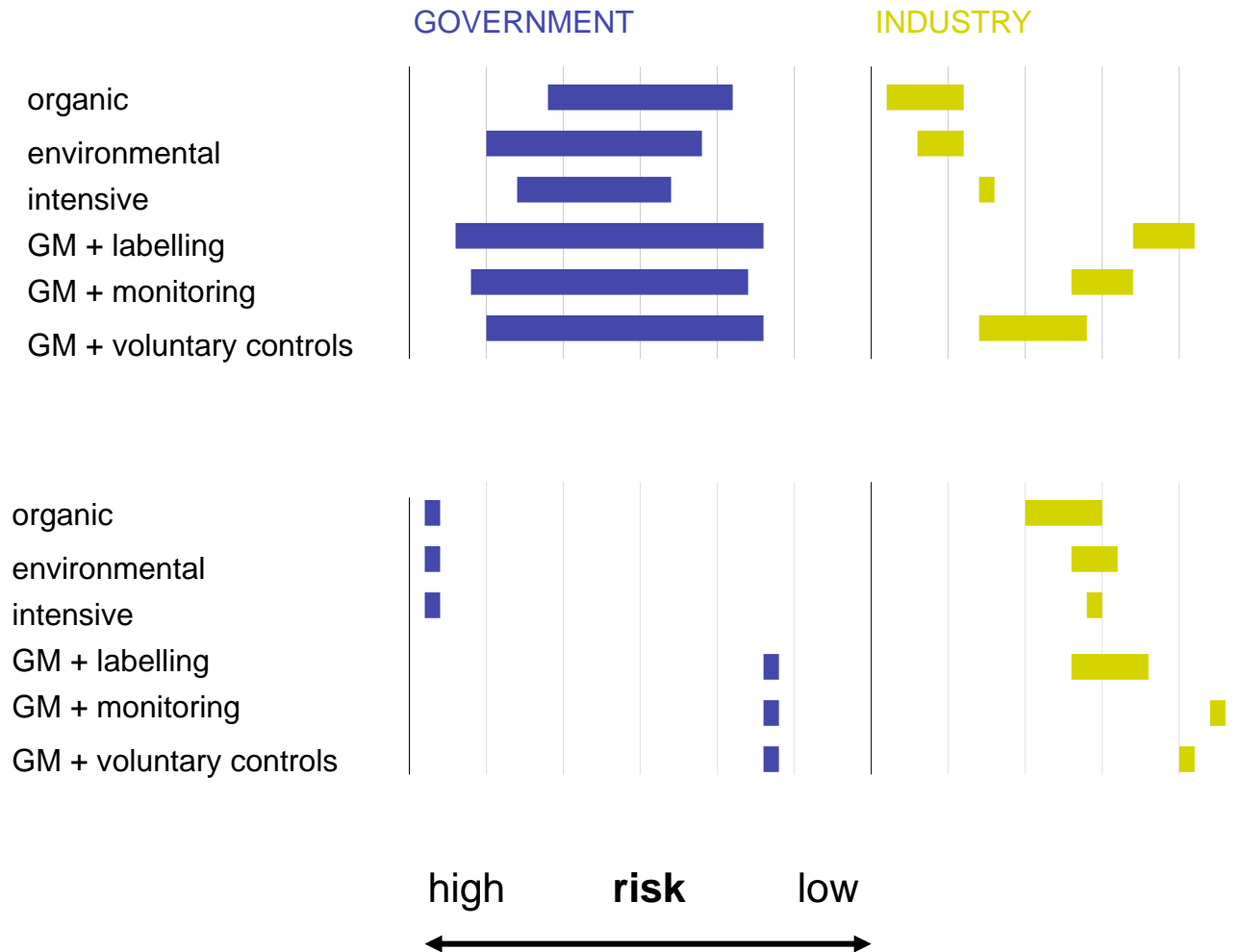
high risk low

# eg: GM Crops

(judgments by expert scientific advisers)

## Risks and benefits of different agricultural strategies

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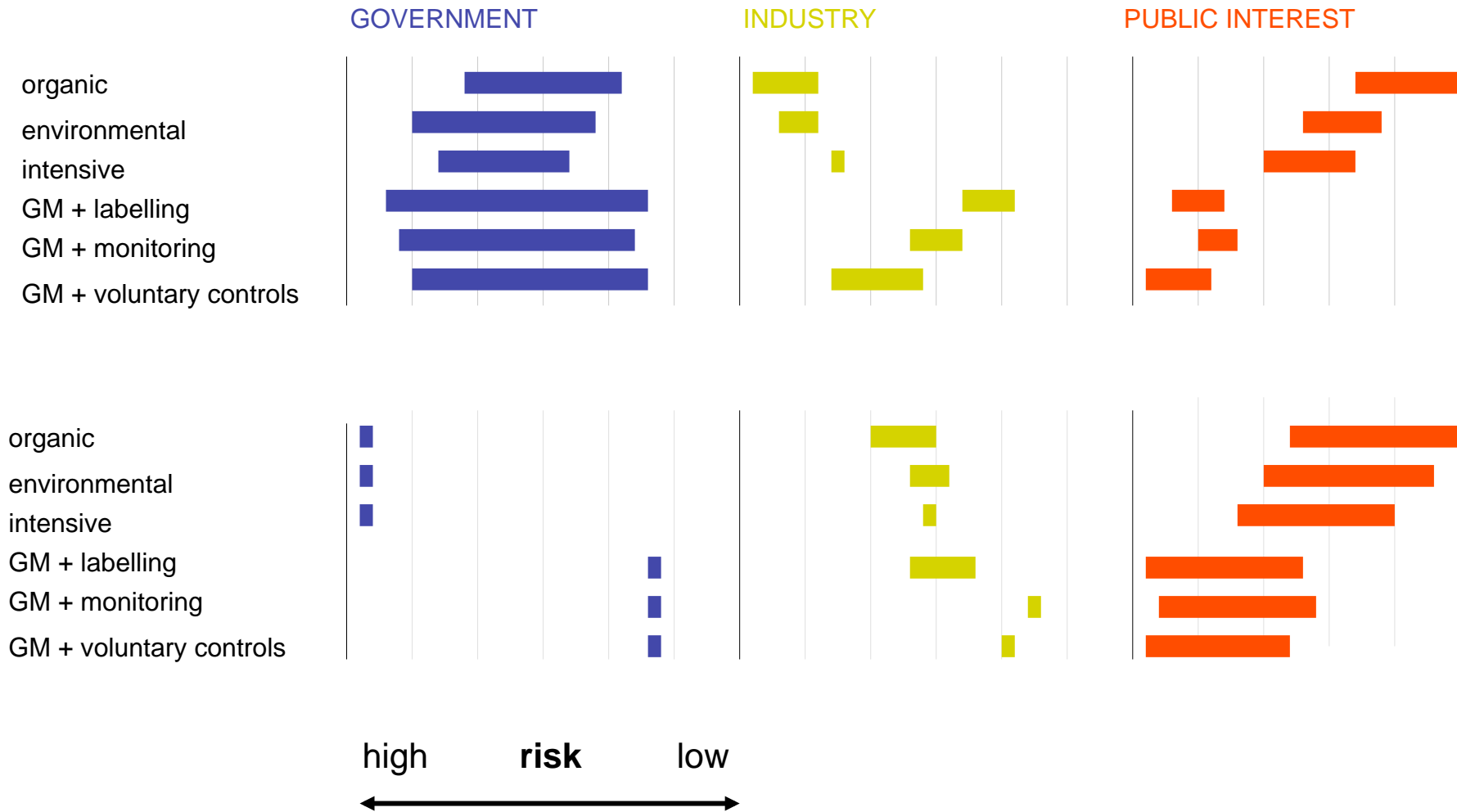


# eg: GM Crops

(judgments by expert scientific advisers)

## Risks and benefits of different agricultural strategies

elicited using multicriteria mapping method in Unilever-sponsored research (2003)



# 'Framing' in Analysis

## Some dimensions of 'framing' in technology appraisal

setting agendas	defining problems	characterising options
posing questions	prioritising issues	formulating criteria
deciding context	setting baselines	drawing boundaries
discounting time	choosing methods	including disciplines
handling uncertainties	recruiting expertise	commissioning research
constituting 'proof'	exploring sensitivities	interpreting results

**eg: regulatory criterion:**

*'safe?'*

*'safe enough?'*

*'safest?'*

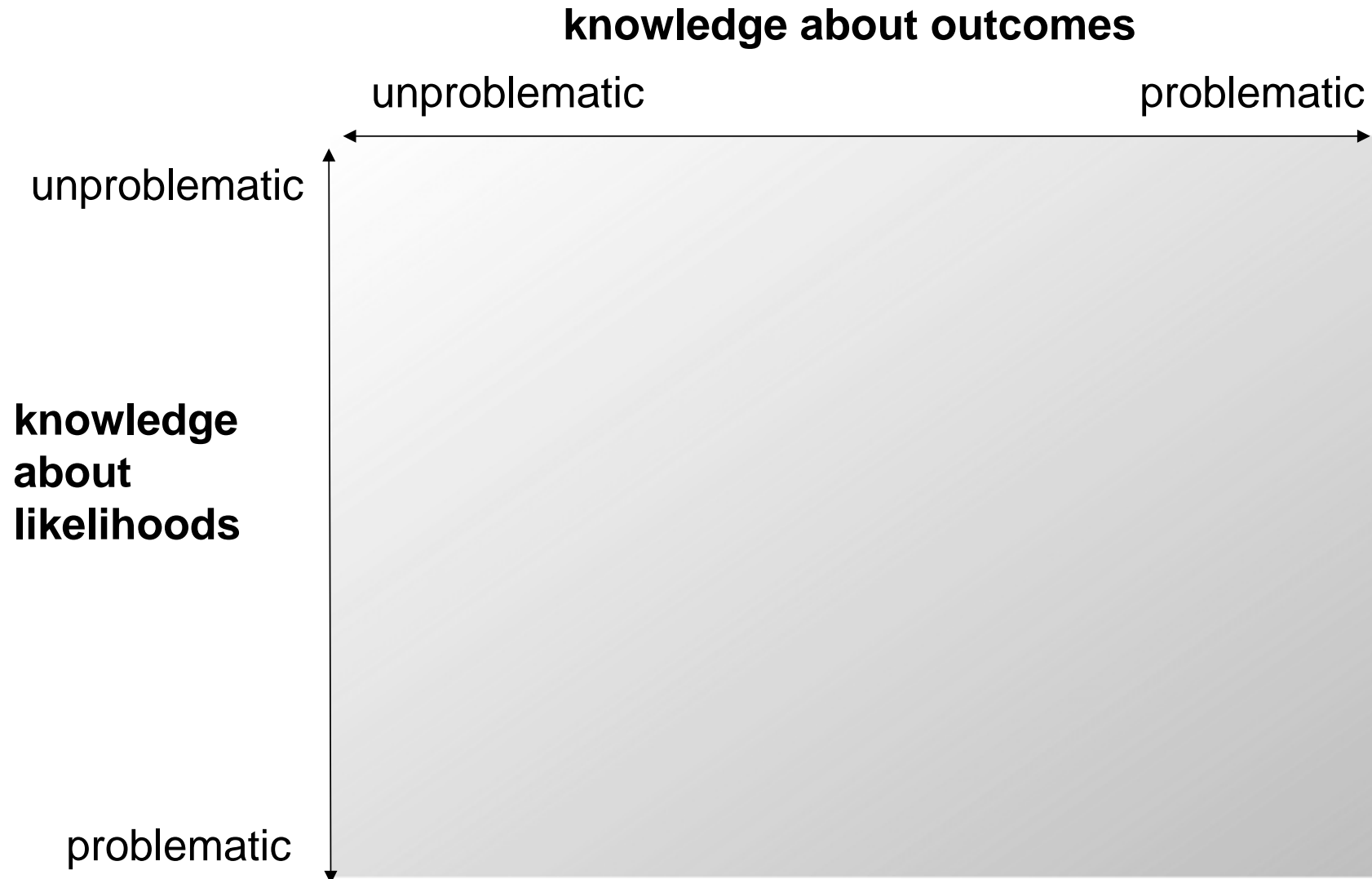
*'best?'*

## All analysis requires framing ... all framing involves values

'sound science' and 'evidence-base' – different answers to different queries  
... we should be as rigorous about validating the questions as the answers

# Precaution and 'Sound Science'

many contrasting aspects of 'incertitude'

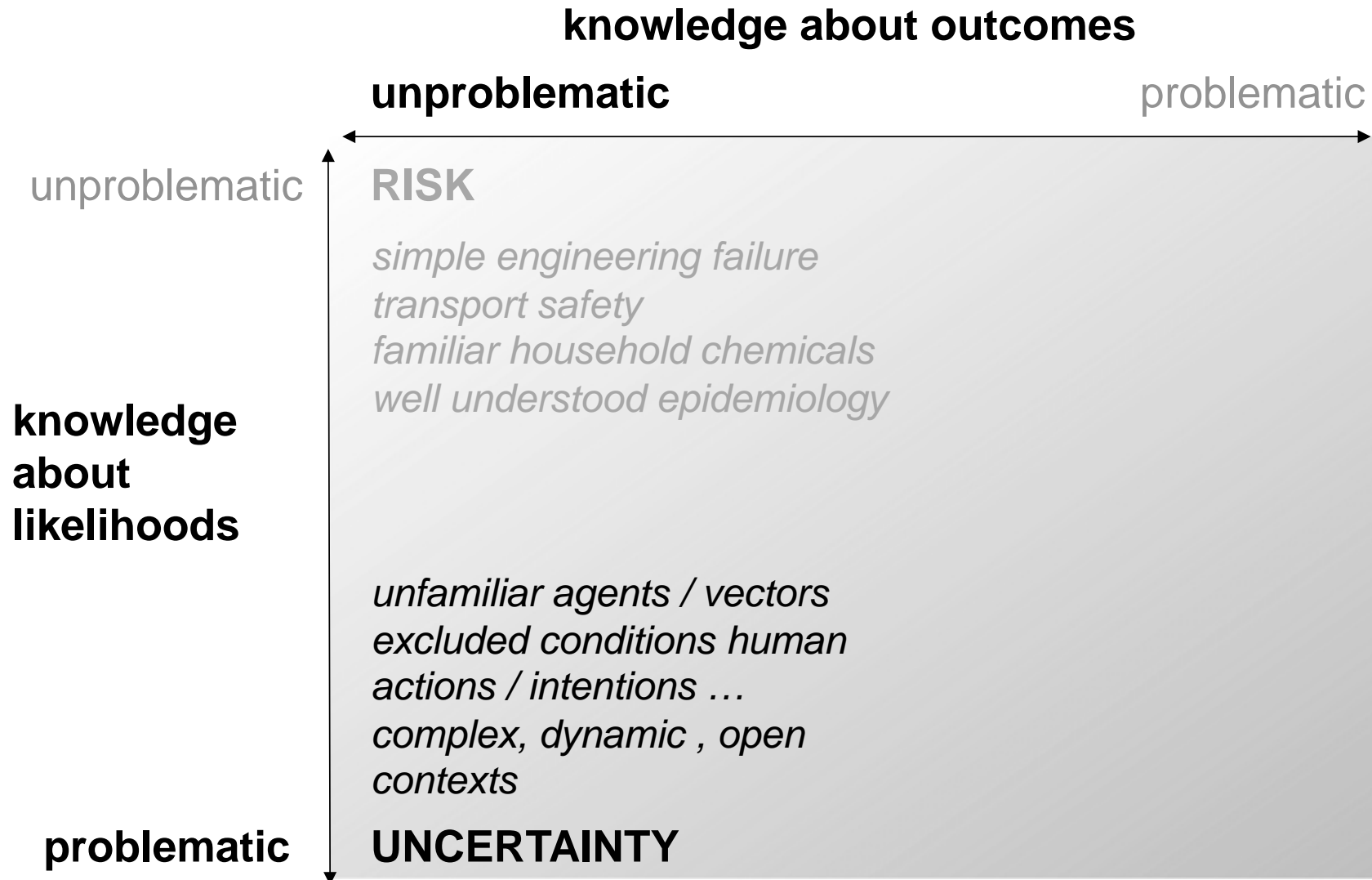


schematic of: Socrates... Knight, Keynes, Loasby, Collingridge, Funtowicz, Ravetz, Wynne, etc



# Precaution and 'Sound Science'

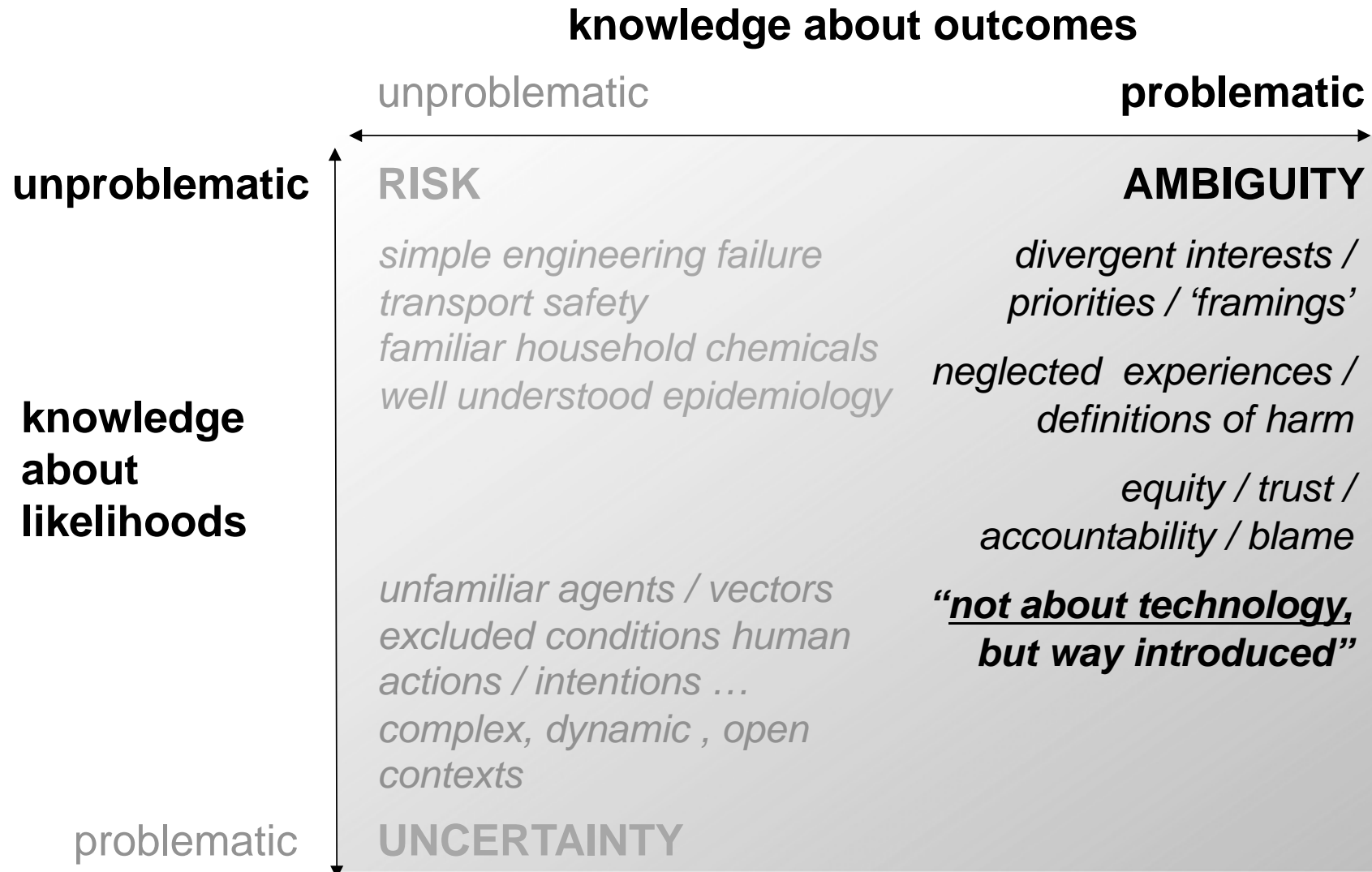
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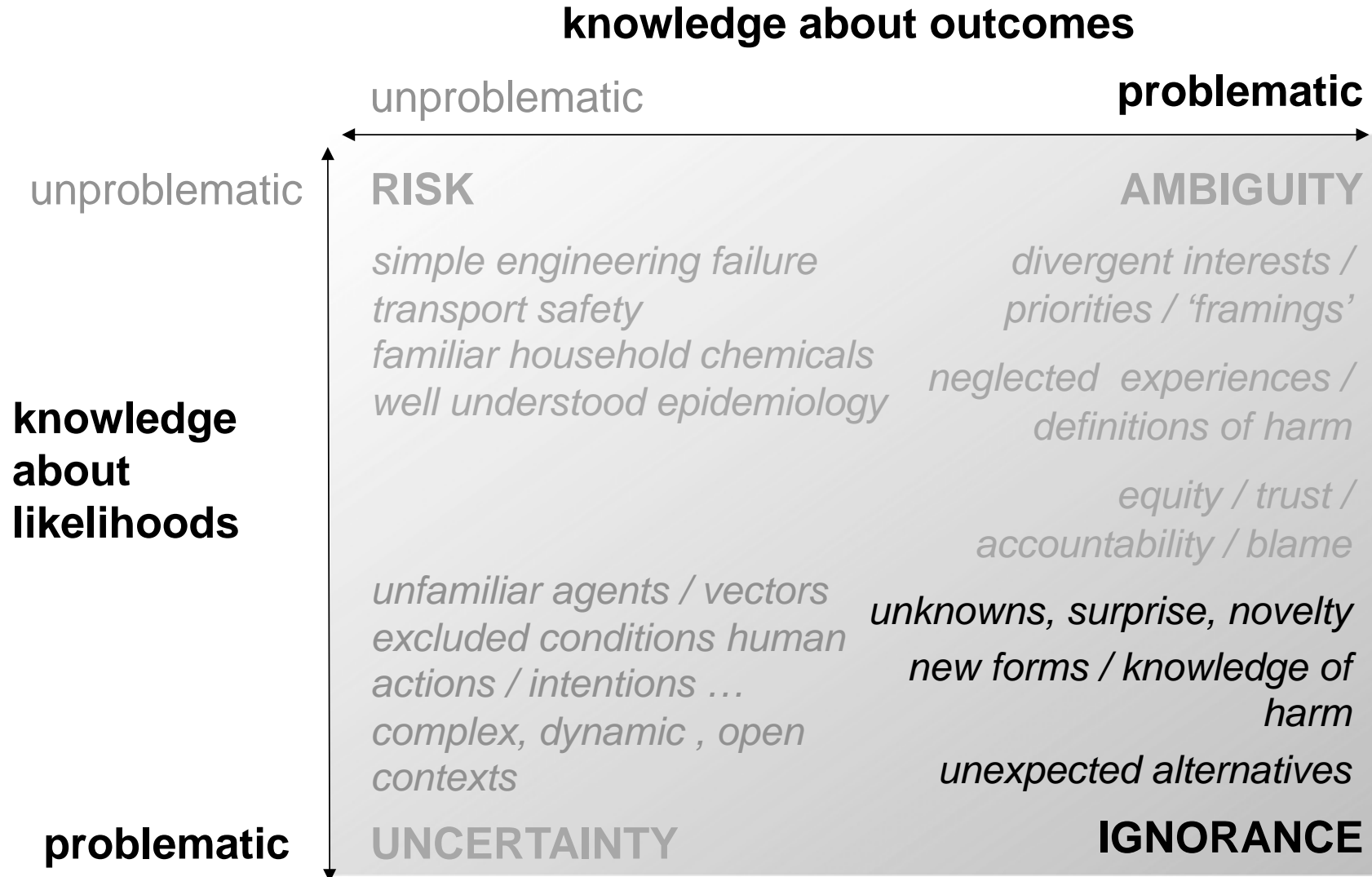
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# Precaution and 'Sound Science'

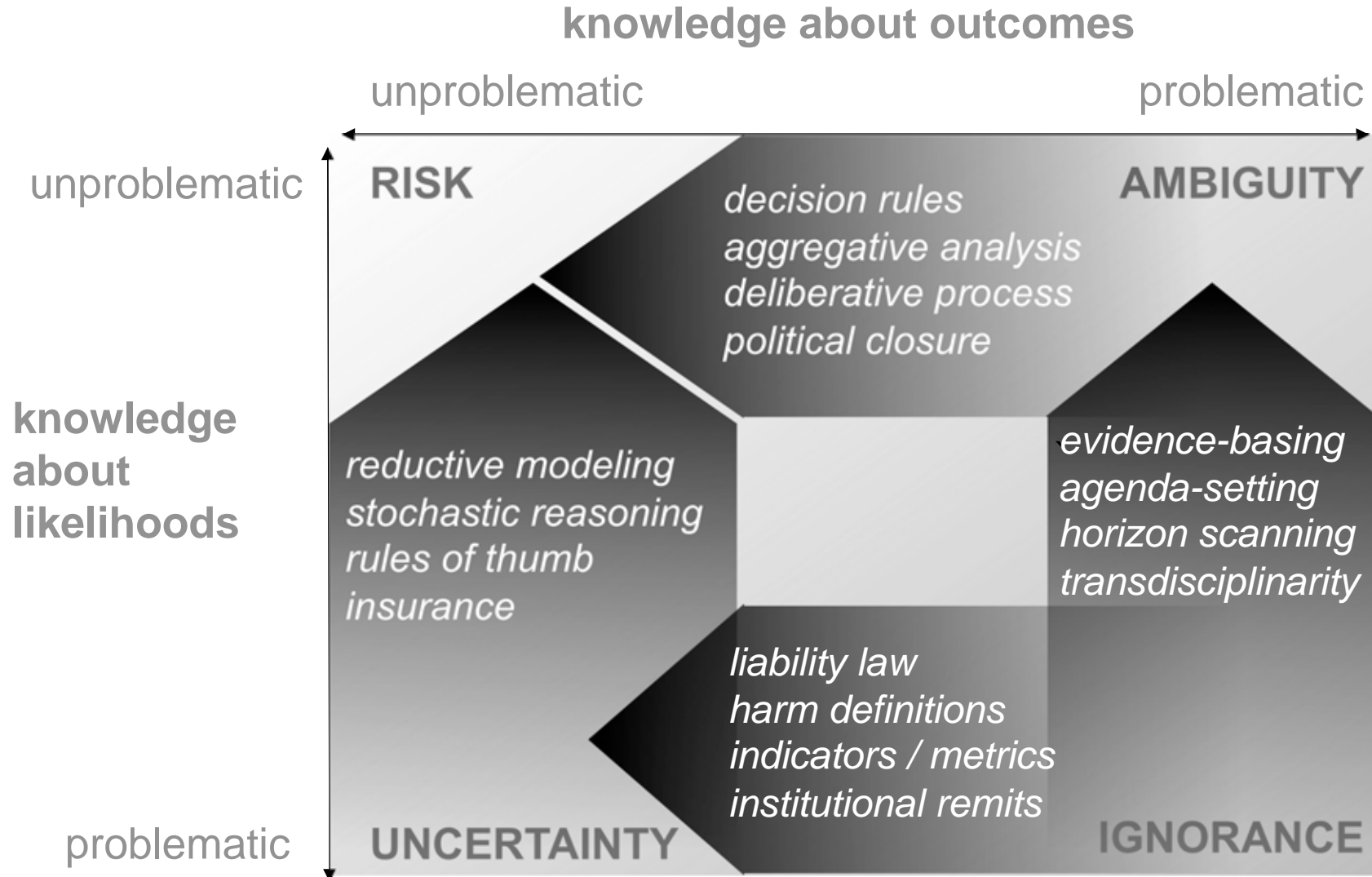
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Scientists know but neglect in policy; media is especially reluctant to acknowledge

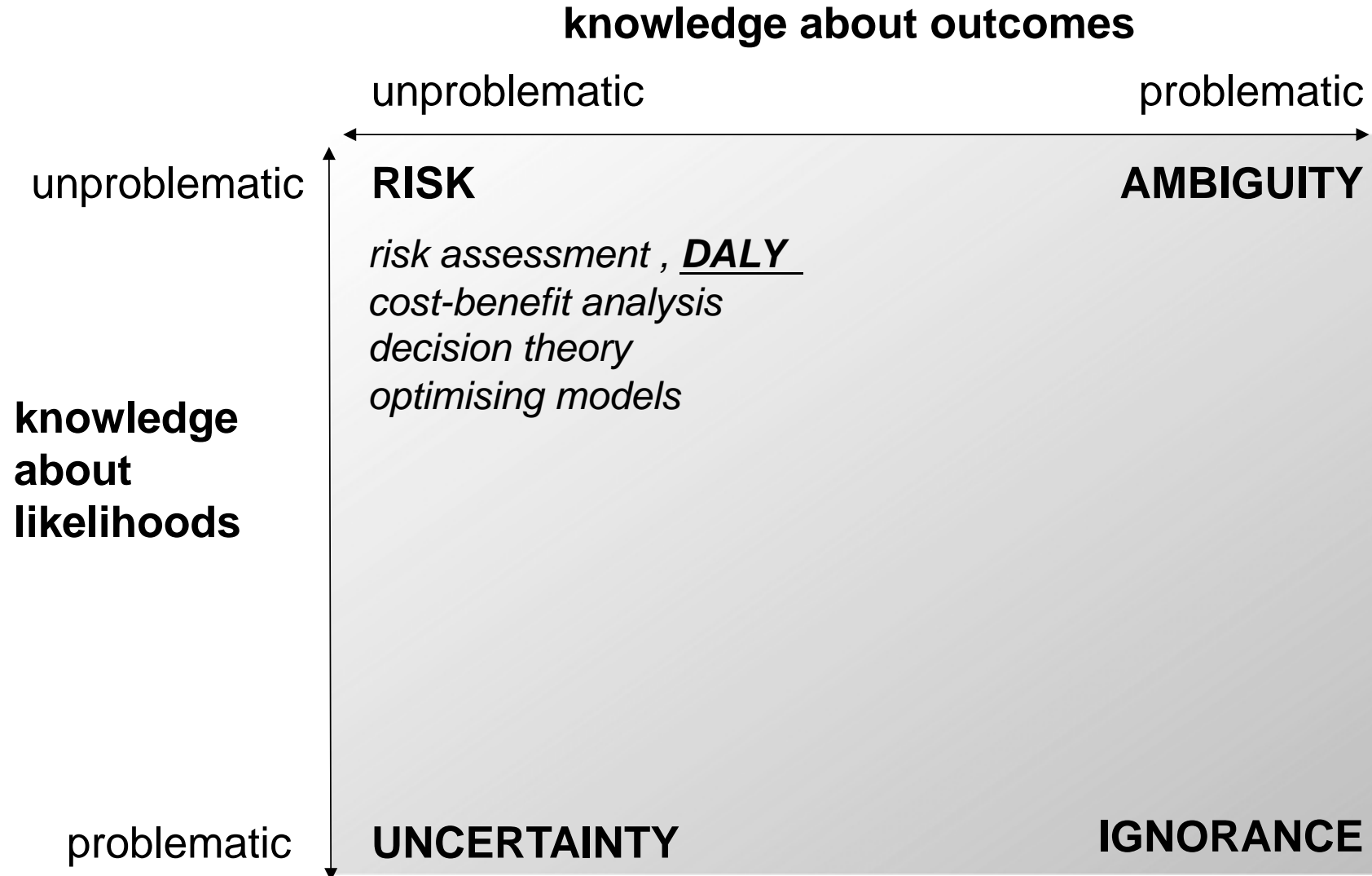
# Power and Knowledge

‘Closing down’ to ‘risk’ – Beck’s “organised irresponsibility”



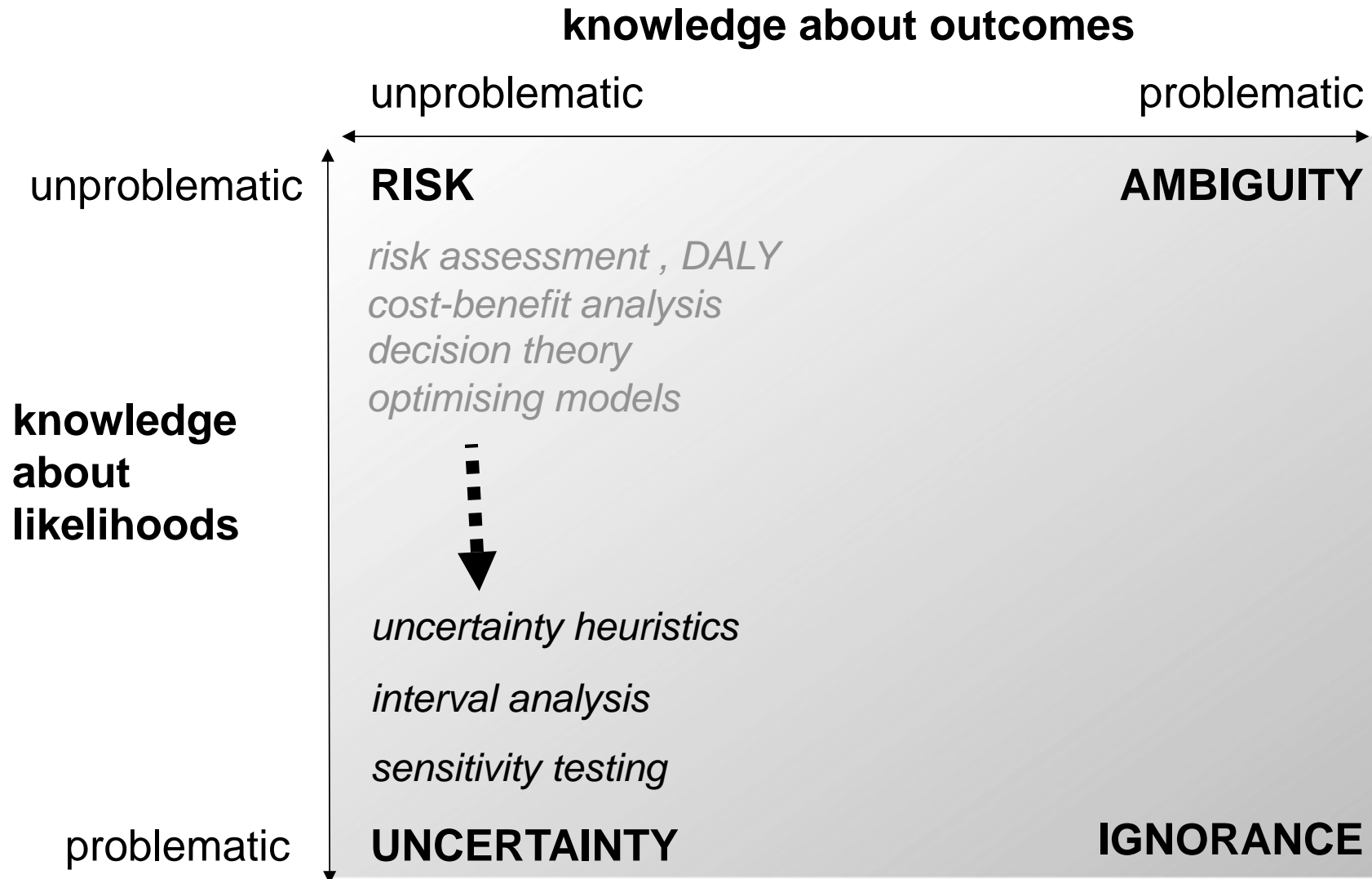
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# Methodological Responses



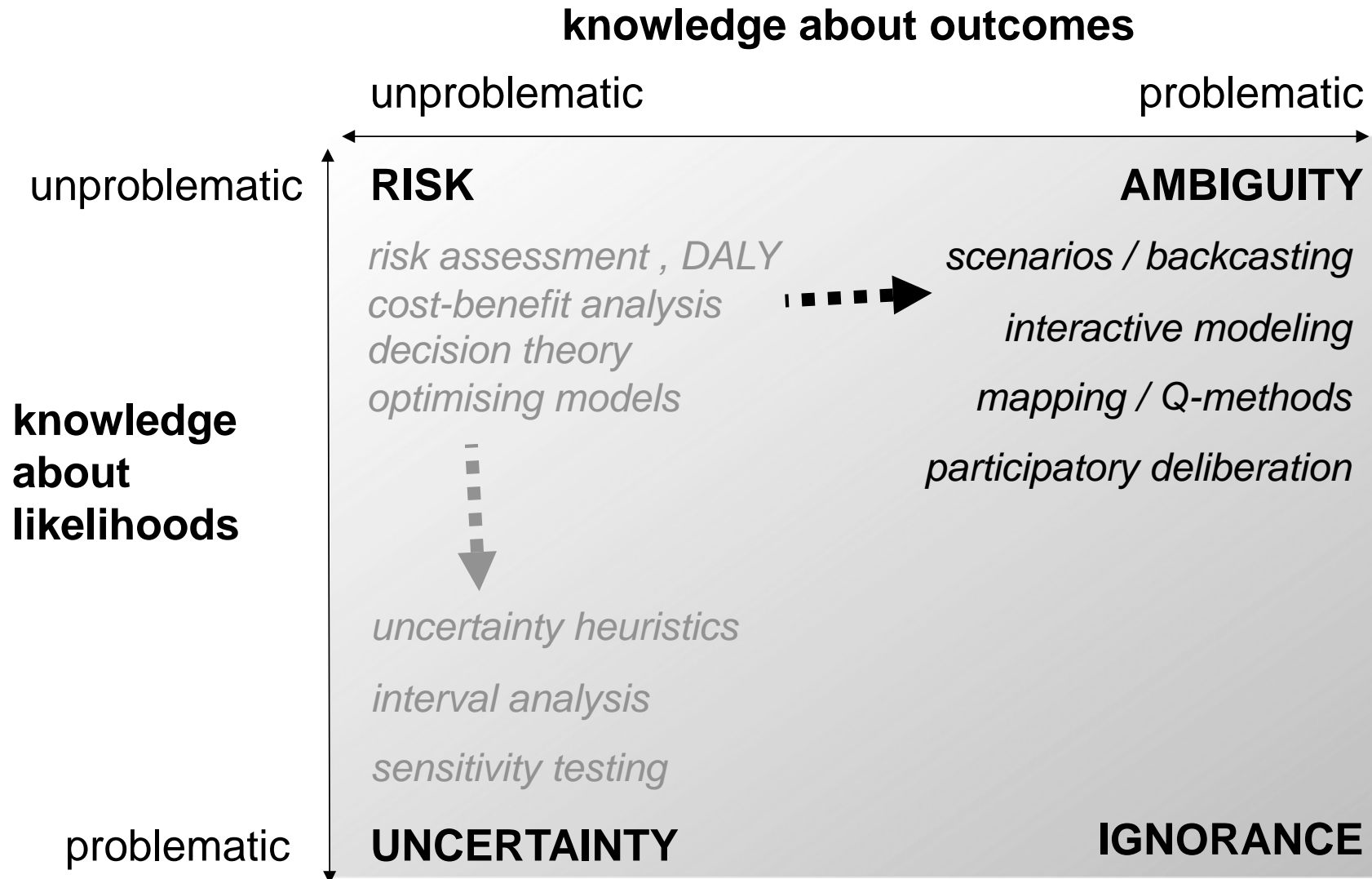
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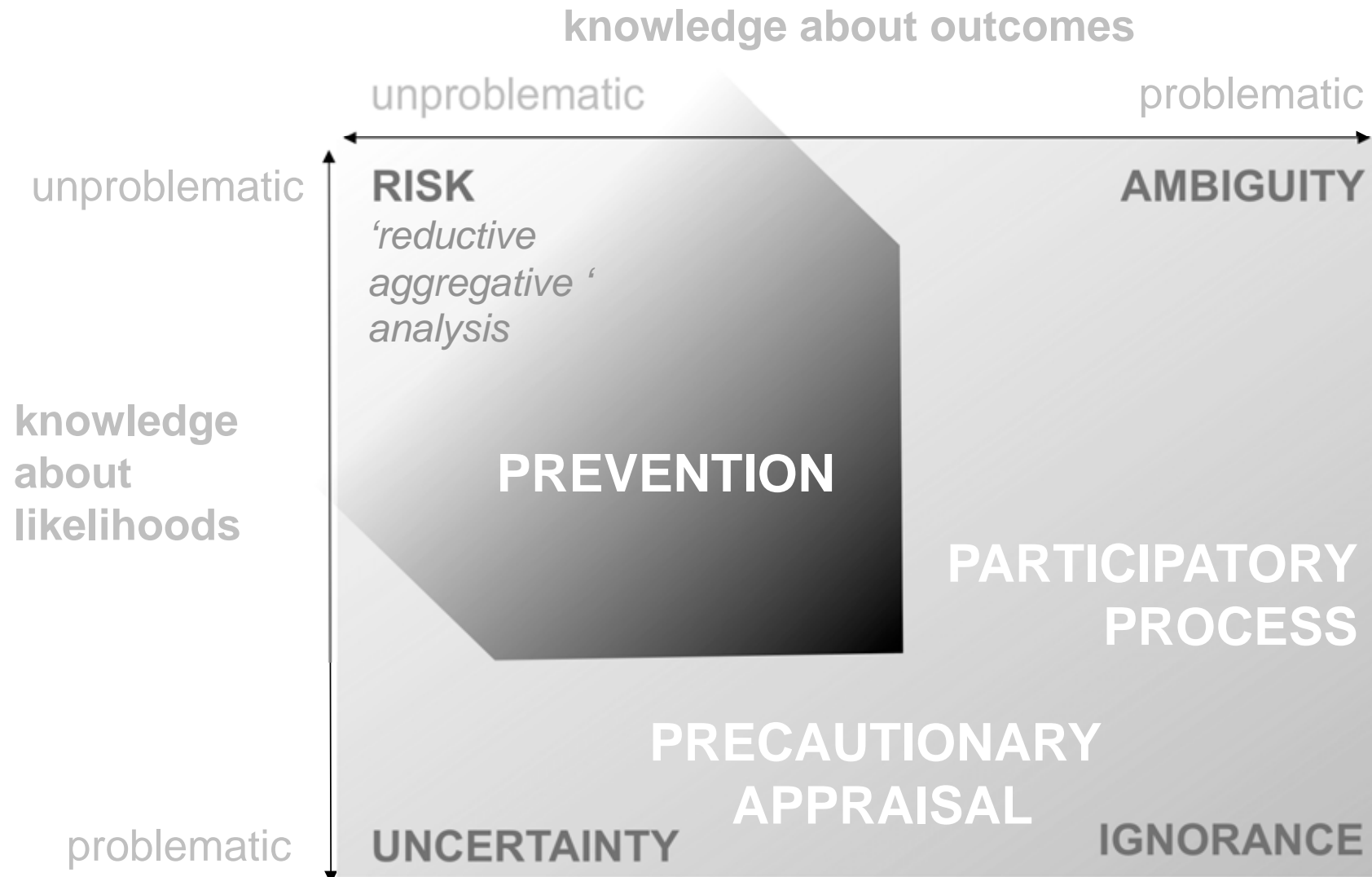


Scientists know but neglect in policy; media is especially reluctant to acknowledge



# Beyond Sound Science / Perception Dichotomy

precaution and participation are about rigour under incertitude



# Precaution as 'Broadening Out' Appraisal *(cf: EEA, 2001)*

as a process, not just a 'decision rule' in risk management

<b>extend scope</b>	additive, cumulative, synergistic effects; life cycles, compliance
<b>humility on science</b>	sensitivities & proxies: mobility, persistence, bioaccumulation
<b>pro-active research</b>	prioritise open monitoring & surveillance & targeted experiment
<b>deliberate argument</b>	levels of proof, burden of evidence, onus of persuasion
<b>alternative options</b>	pros, cons, justifications for range of options & substitutes
<b>cross-disciplinary learning</b>	collect all relevant knowledge, beyond the 'usual suspects'
<b>engage public</b>	independence through pluralism and robustness on values

# Politics-Denial in Technology Governance

**all innovation is good...**

*“For the objectives of the Lisbon Strategy ...  
**pro-innovation** action [is] a priority.”*

*European Parliament, 2006*

*“[we need] more **‘pro-innovation’** policies ...”*

*Gordon Brown, 2006*

**all technology is good...**

*“[there is] an **anti-technology** culture in the  
UK ... a pro- technology culture  
must be created...”*

*- UK Council for Science and Technology, 2000*

**all science is good...**

*“science needs political support ... politicians ...  
are affected by the **anti-science** or anti-  
technology feelings of influential intellectuals.”*

*- EU High Level Group on Science &  
Technology*



# Politics-Denial in Technology Governance

conventional 'linear' understandings of technology change still prevail in mainstream technology governance

eg:

*"history is a **race to advance technology**"*

- UK Royal Academy of Engineering

*'**anti-technology protestors**' are "... members of the '**flat earth society**', opposed to modern economics, modern technology, modern science, **modern life itself.**"*

- UN DDG

FUTURE



*time*

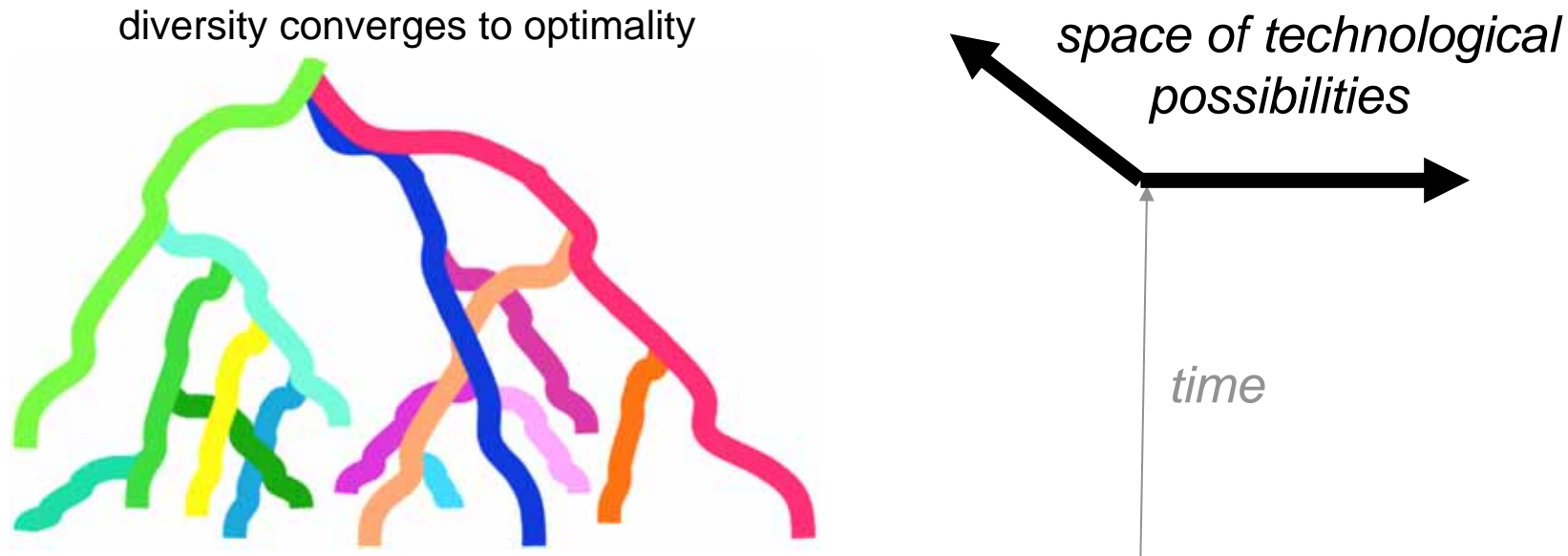
PAST

Treats innovation as homogeneous:

*no distinctions ... no alternatives ...  
no politics ... no choice !*

For every 'over-regulating' 'red flag law', how many cases of under-regulation, eg: *asbestos, benzene, lead, pthalidomides, PCBs, dioxins, TBTs, CFCs, TSEs, GHGs ?*

# Technological Progress as Optimisation

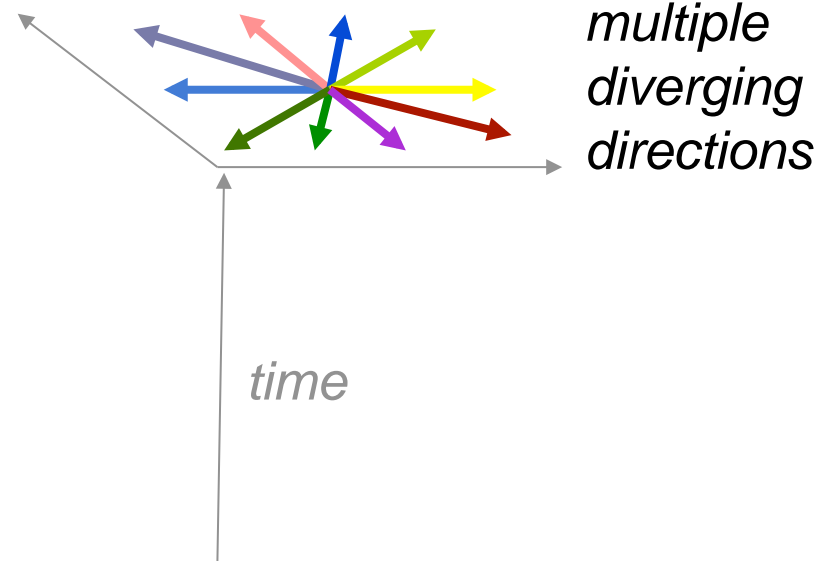


## Mainstream policy representations of technology change:

- 'sound science'
- technical convergence
- material constraints,
- market equilibrium

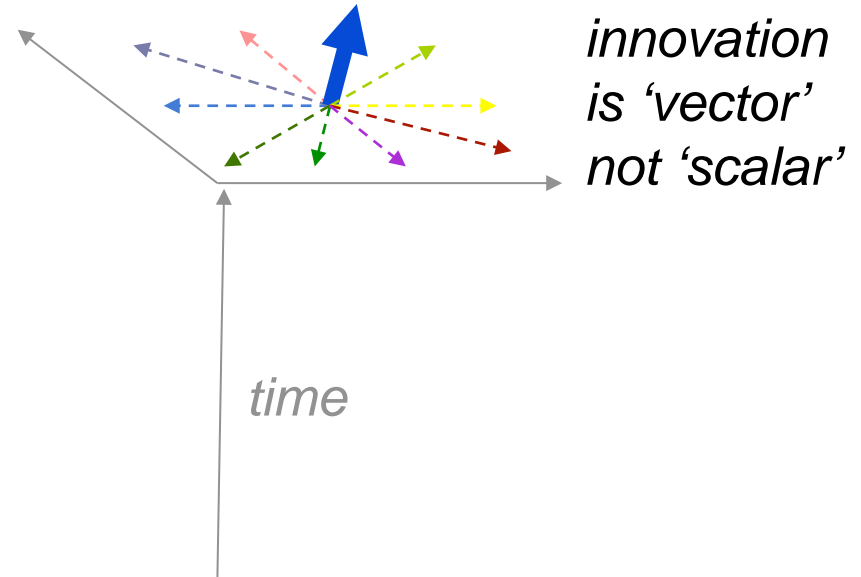
yield 'optimal' technological / institutional configurations

# Technological Progress as Social Choice



**Common picture arising in all studies of technology in society –**

# Economics and the Normativity of Direction



**a diversity of processes ‘close down’ possible directions of change**

**economics:**

homeostasis (*Sahal, 85*)

lock-in (*Arthur, 89*)

regimes (*Nelson & Winter, 77*) trajectories (*Dosi, 82*)

**history:**

contingency (*Mokyr, 92*)

momentum (*Hughes 83*)

path-dependence (*David, 85*)

**philosophy/politics:**

autonomy (*Winner, 77*)

closure (*Feenberg, 91*)

entrapment (*Walker, 01*)

alignment (*Geels,*

**social studies:**

shaping (*Bijker, 85*)

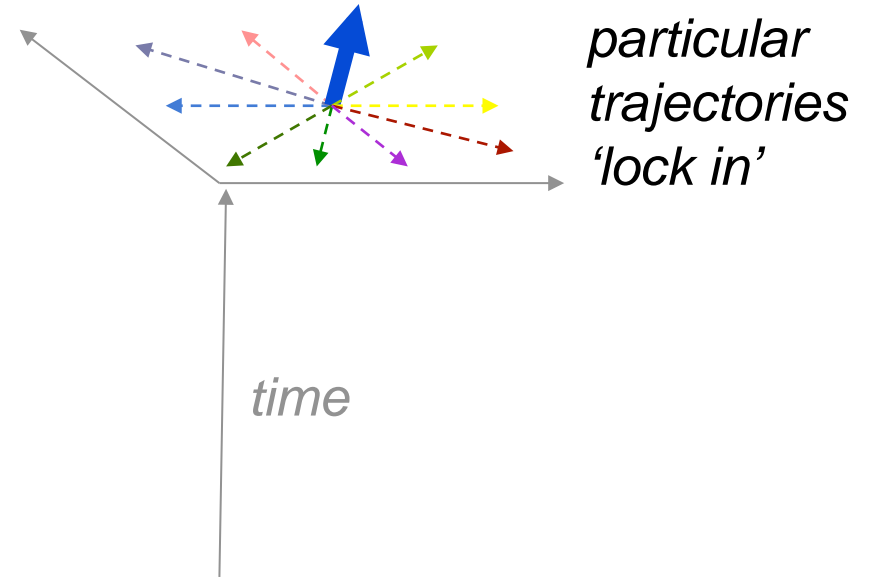
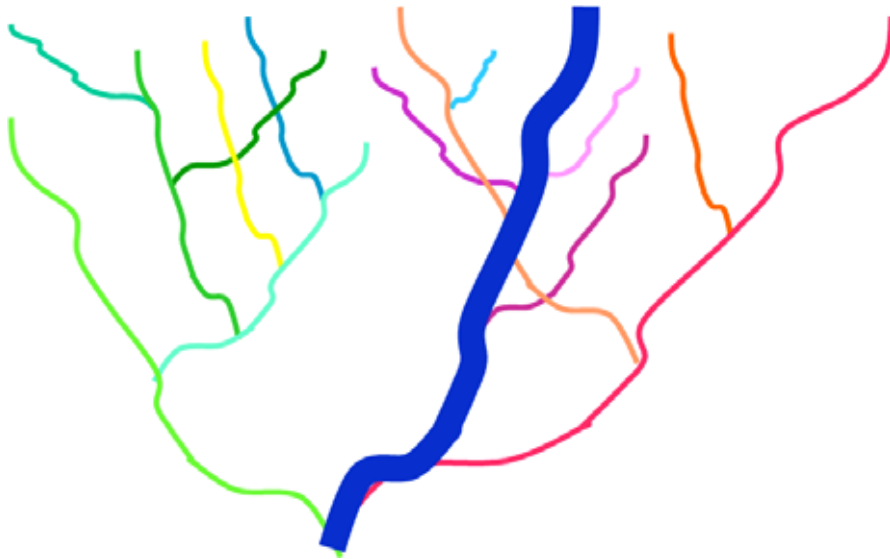
co-construction (*Misa, 03*)

expectations (*Brown, 03*)

imaginaries

(*Jasanoff, 05*)

# Historic 'Branching Paths'

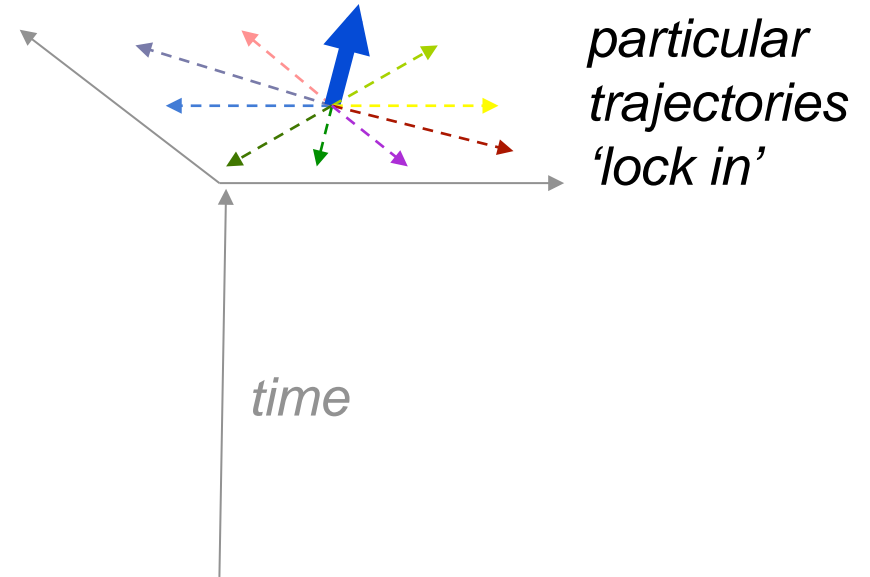


**Many familiar examples of repeated 'lock-in' to poor choices**

- QWERTY keyboards
- ... light water reactors ...
- ... military systems ...



# Historic 'Branching Paths'



**Many familiar examples of repeated 'lock-in' to poor choices**

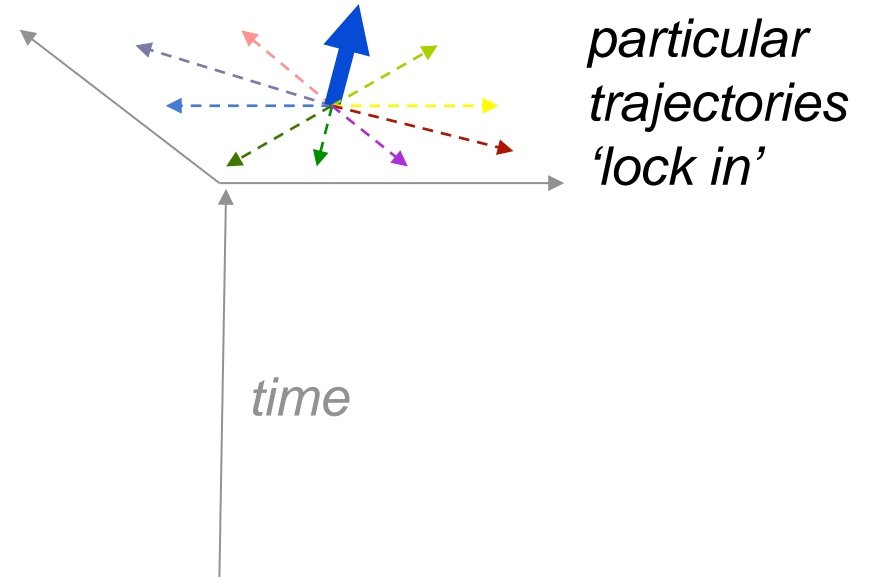
Narrow Gauge Railways

... urban transport ...

... internal combustion engine ...



# Historic 'Branching Paths'



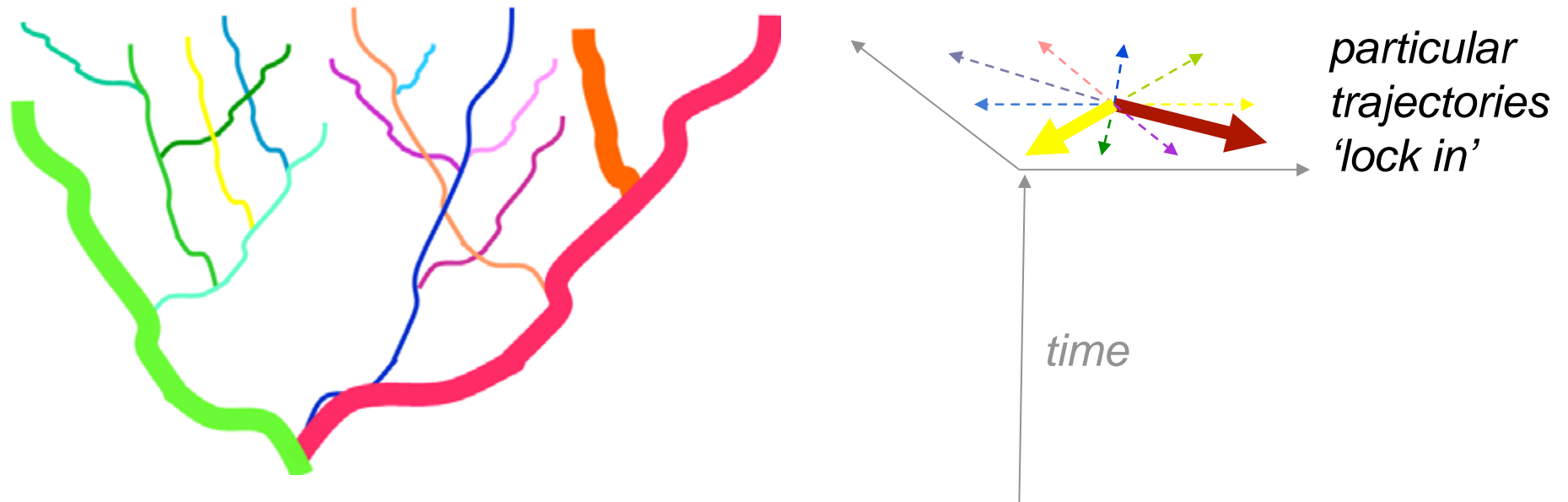
**Many familiar examples of repeated 'lock-in' to poor choices**

- VHS and Betamax
- ... media standards ...
- ... Windows software...



**Deliberately or not – society makes its technological futures**  
pressures intensify with globalisation, harmonisation, standardisation

# Alternative 'Possible Futures'

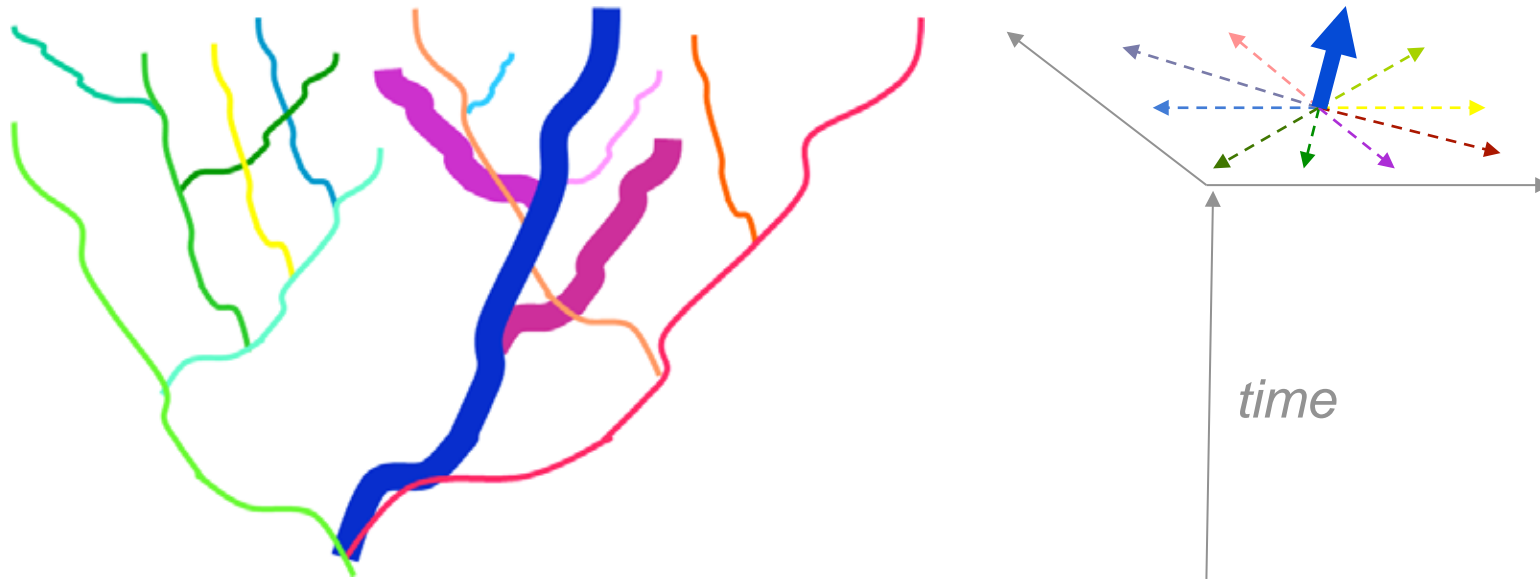


## Contending priorities & plural knowledges yield diverse pathways:

**seed production:**  
all are technically feasible,  
and potentially economically  
viable, but not all can be  
fully realised together ...  
... especially in a standardising,  
harmonising, globalising world

- genetic modification;
- marker assisted breeding;
- commercial industrial hybrids;
- public open source research;
- participatory breeding
- syngenics;
- apomixis;

# Alternative 'Possible Futures'



Contending priorities & plural knowledges yield diverse pathways:  
**look beyond single favoured option, to alternative opportunities**

**Precaution – not about :** - yes or no? - how fast? - who leads?  
**– but about:** - which ways? - why? - says who?

If ignore this, narrow agbiotech agendas are partisan politics not science

# Precaution: a healthier politics of biotech innovation?

**False dichotomy:** rational science **vs** emotive perception/precaution

All analysis & deliberation 'framed' by priorities, values and interests

**Misleading language:** pro- / anti- rhetorics' obscure plural ***directions***

**Media** responsibility to promote realism and accountability about uncertainty

**Precaution:** 'broadening out' methods, options, perspectives

Rigour over uncertainty, ambiguity, ignorance on implications of directions

**Participation:** not in itself a panacea for enabling more democratic choice

Vulnerable (like analysis) to instrumental pressures for justification

**'Opening up':** inform and catalyse more mature politics of technology

Reflexivity on contending values & interests in social choice of technology

**Practical approaches:** many ways to 'open up' analysis & deliberation

Mapping methods, participatory modeling, plural and conditional advice

**Addresses both scientific rigour and democratic accountability**

