

US

University of Sussex

SPRU – Science & Technology Policy Research



Opening Up Scientific Incertitude:

implications of uncertainty
for science policy and expert evidence

presentation to International Symposium on
Scientific Incertitude and Society: Lessons from Law Courts
Hitotsubashi Memorial Hall, National University, Tokyo,
26 August 2012

Andy Stirling
SPRU & STEPS Centre

'Sound Science' in Policy and Regulation

on zoonotic pandemics:

"... sound science ... science-based decisions"

- UN WHO DG Margaret Chan

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:

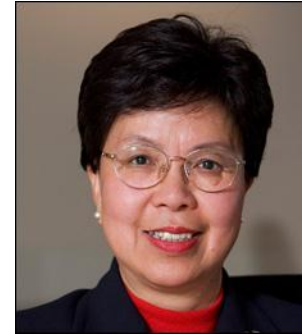
*"... **sound science** will be the basis of the Commission's legislative proposal..."*

- EC RTD Commissioner, Philippe Busquin

on energy:

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

former UK Energy Minister Malcolm Wicks



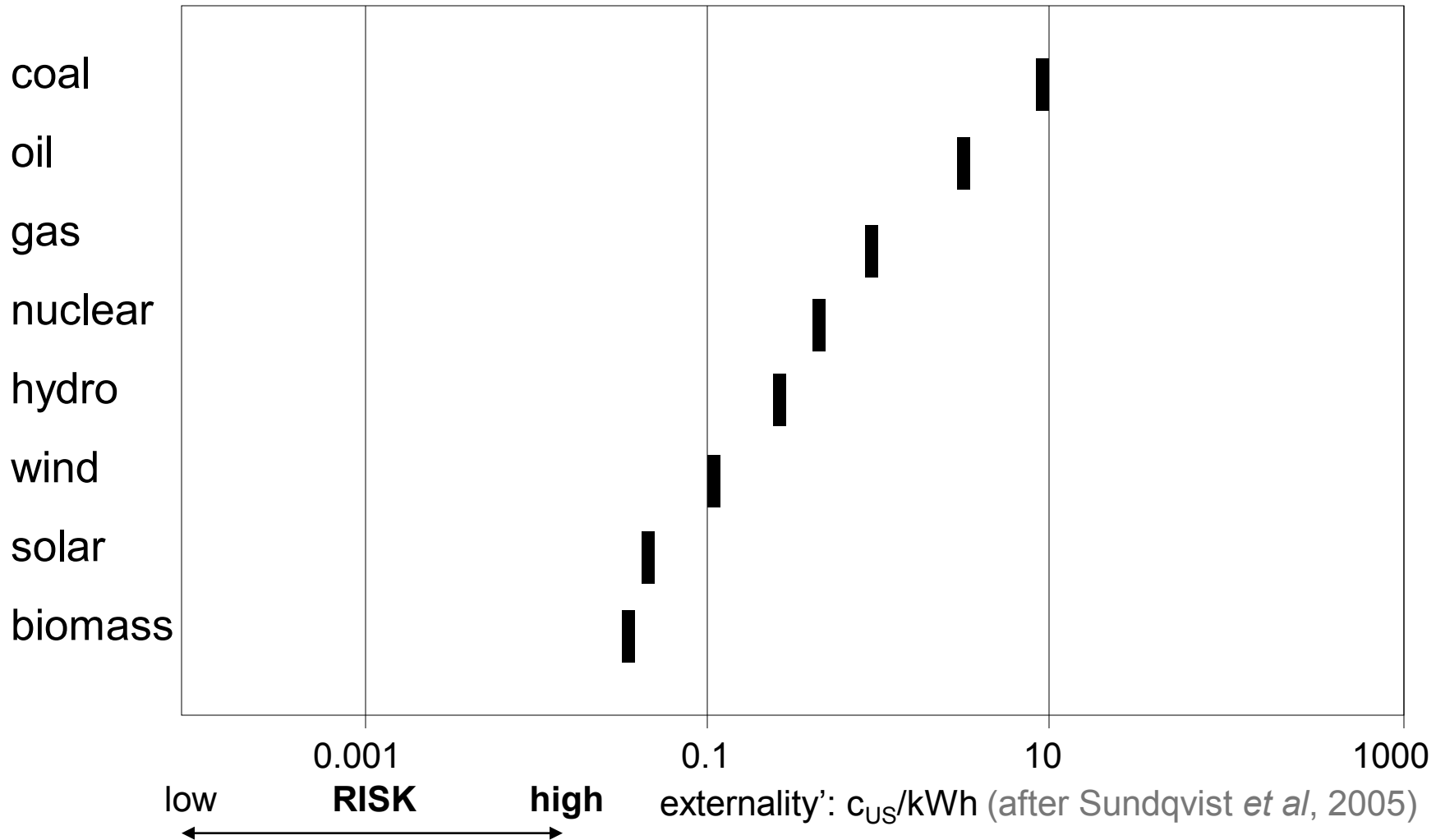
Justification: from political 'problems' to technical 'puzzles'

Ambiguity in Evidence

Energy technologies: mature, sophisticated comparative analysis...

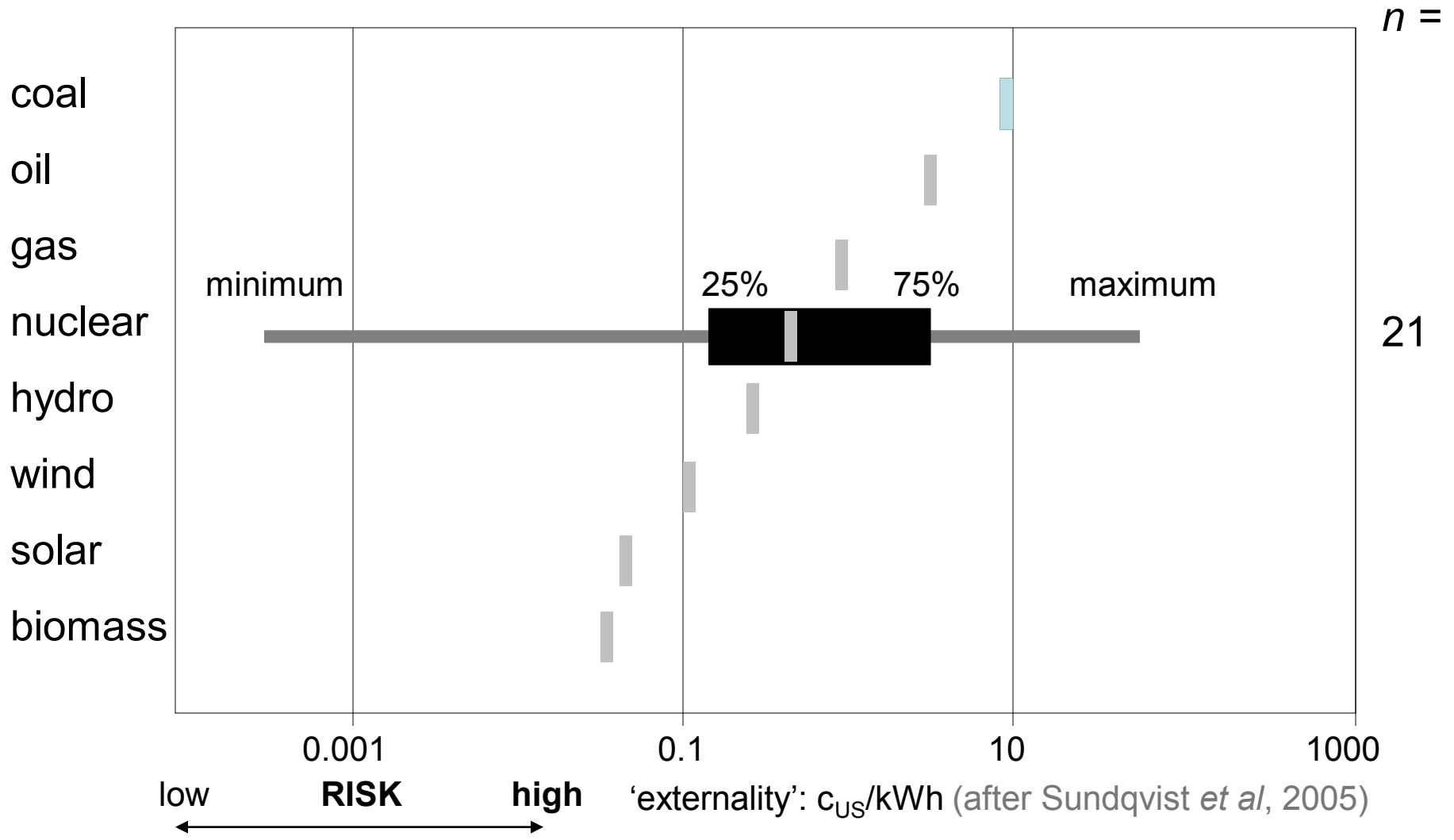
Ambiguity in Evidence

Energy technologies: mature, sophisticated comparative analysis...



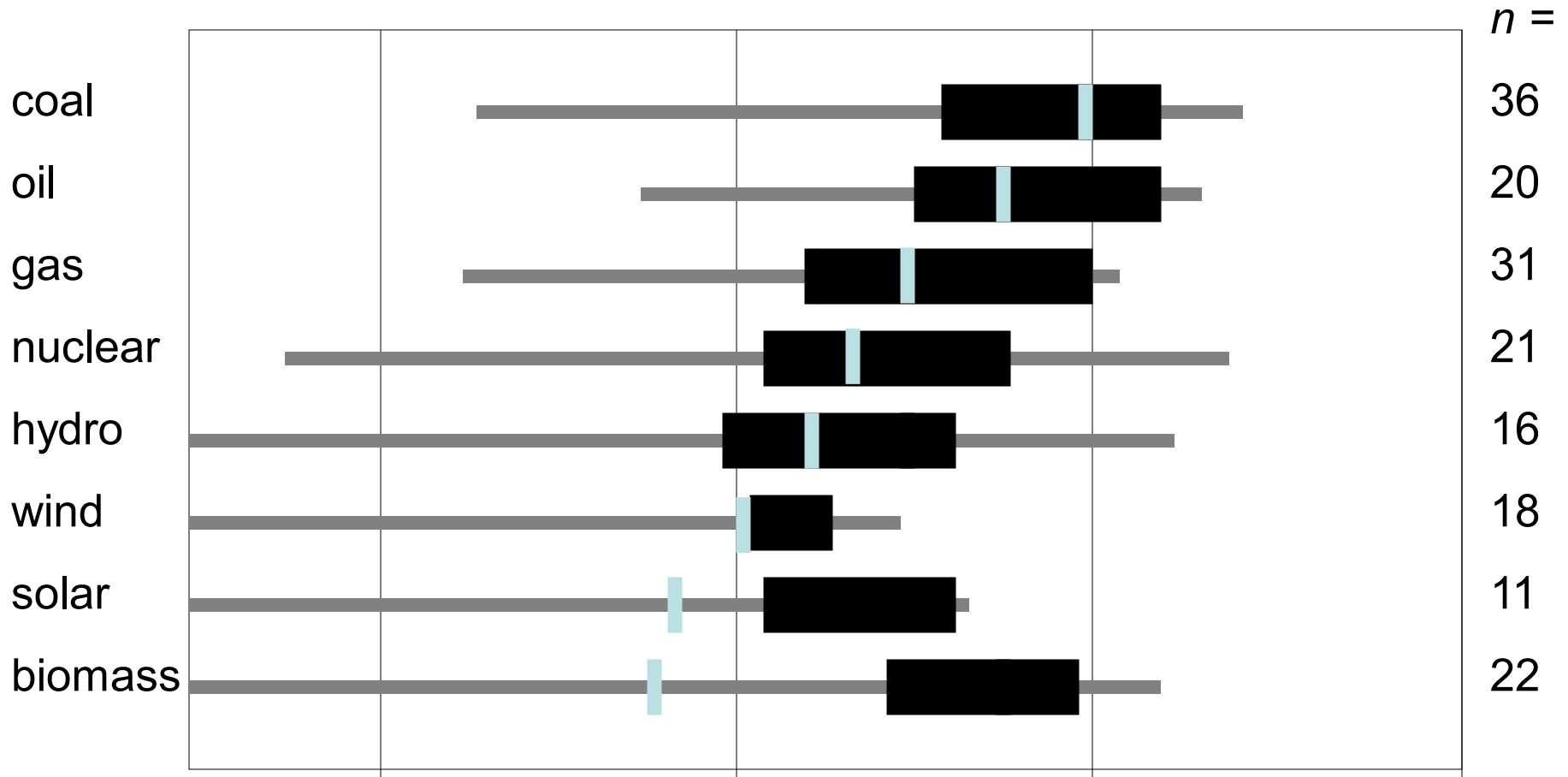
Ambiguity in Evidence

Energy technologies: mature, sophisticated comparative analysis...



Ambiguity in Evidence

Energy technologies: mature, sophisticated comparative analysis...



Knowing Knowledge

Conventional 'risk practices' suppress our 'knowledge about knowledge'

Knowing Knowledge

Conventional expert practices suppress our 'knowledge about knowledge'

marginalises, elides, ignores, (often) denies radical openness of 'incertitude':

- **insufficiency:** knowledge efficacy is not normative basis for
action *Aristotle, Kant, Habermas know-how is less important than know-why*

– eg: *how to apply neuroscience?*



Knowing Knowledge

Conventional expert practices suppress our 'knowledge about knowledge'

marginalises, elides, ignores and (often) denies **realities** of knowledge:

- **insufficiency:** knowledge efficacy is not normative basis for action

- **incompleteness:** knowledge enabling utility is limited on wider effects
Lao Tzu, Socrates, Keynes 'unknowns' as important as 'knowns'

– eg: *unexpected mechanisms in nanohealth technologies*



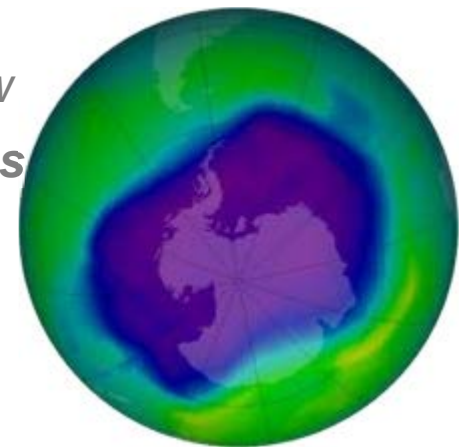
Knowing Knowledge

Conventional expert practices suppress our 'knowledge about knowledge'

marginalises, elides, ignores and (often) denies **realities** of knowledge:

- **insufficiency:** knowledge efficacy is not normative basis for action
- **incompleteness:** knowledge enabling utility is limited on wider effects
- **indeterminacy:** effective knowledge does not preclude surprise
Gödel, Dosi, Collingridge "known knowns" foster hubris

– eg: dangers of thinking we know
halogenated hydrocarbons
CFCs and the ozone hole
endocrine disruptors
methyl tertbutyl ether



Knowing Knowledge

Conventional expert practices suppress our 'knowledge about knowledge'

marginalises, elides, ignores and (often) denies **realities** of knowledge:

- **insufficiency:** knowledge efficacy is not normative basis for action

- **incompleteness:** knowledge is always limited as a basis for action

- **indeterminacy:** effective knowledge does not preclude surprise

- **'iversity':** increased knowledge can increase ignorance

Einstein, Ravetz, Beck...

area / perimeter of known

– *nonlinear
dynamics
of climate
and oceans*



Knowing Knowledge

Conventional expert practices suppress our 'knowledge about knowledge'

marginalises, elides, ignores and (often) denies **realities** of knowledge:

- **insufficiency:** knowledge efficacy is not normative basis for action

- **incompleteness:** knowledge is always limited as a basis for action

- **indeterminacy :** effective knowledge does not preclude surprise

- **'iversity':** increased knowledge can increase ignorance

- **intractability:** knowledge-commitments compound

vulnerability *Ellul, Wynne, Tenner not existence but exposure to unknown*

eg: nuclear

dependency



Knowing Knowledge

Conventional expert practices suppress our 'knowledge about knowledge'

marginalises, elides, ignores and (often) denies **realities** of knowledge:

- **insufficiency:** knowledge efficacy is not normative basis for action
- **incompleteness:** knowledge is always limited as a basis for action
- **indeterminacy :** effective knowledge does not preclude surprise
- **'iversity':** increased knowledge can increase ignorance
- **intractability:** knowledge-commitments compound vulnerability
- **incommensurability:** knowledges are plural and often conflicting
Kuhn, Arrow, Jasanoff...
knowledge often not linear / additive
 - eg: agronomy, ecology, soil science, molecular biology on **GM**



Knowing Knowledge

Conventional expert practices suppress our 'knowledge about knowledge'

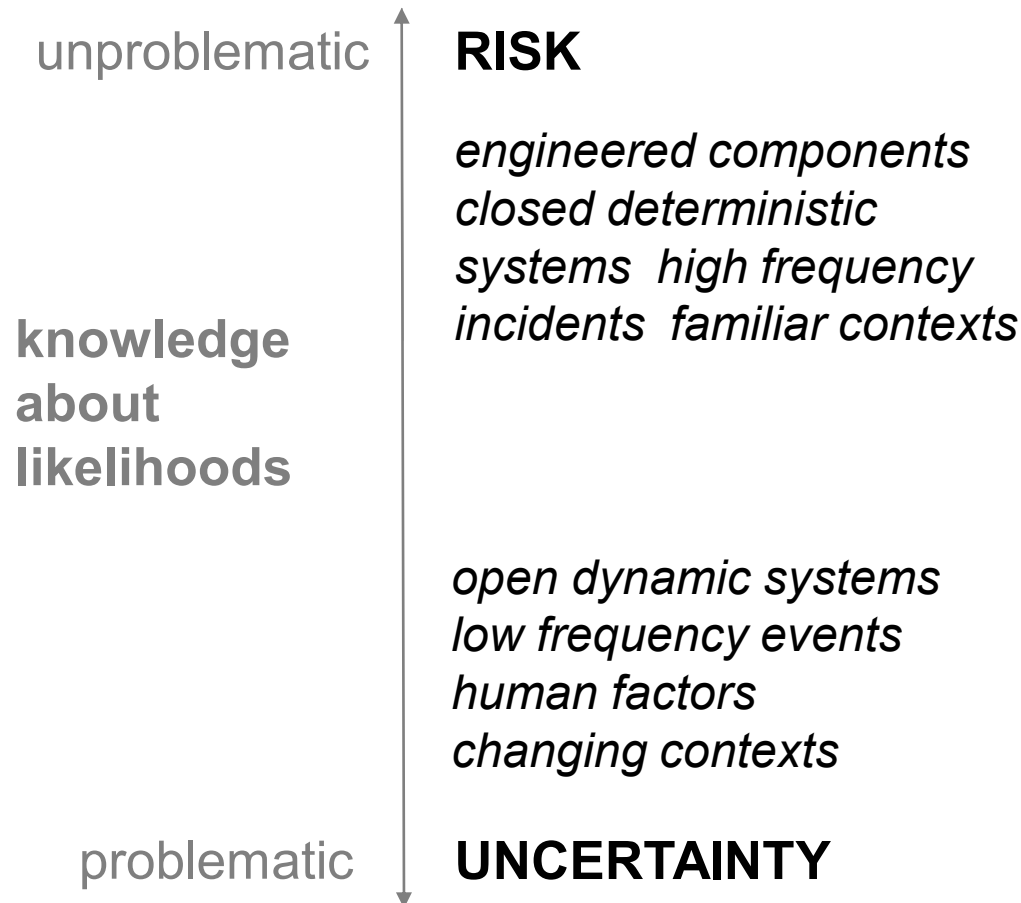
marginalises, elides, ignores and (often) denies **realities** of knowledge:

- **insufficiency:** knowledge efficacy is not normative basis for action
- **incompleteness:** knowledge is always limited as a basis for action
- **indeterminacy:** effective knowledge does not preclude surprise
- **'iversity':** increased knowledge can increase ignorance
- **intractability:** knowledge-commitments compound vulnerability
- **incommensurability:** knowledges are plural and often conflicting

representing incomplete knowledge as expert 'risk' is deeply problematic

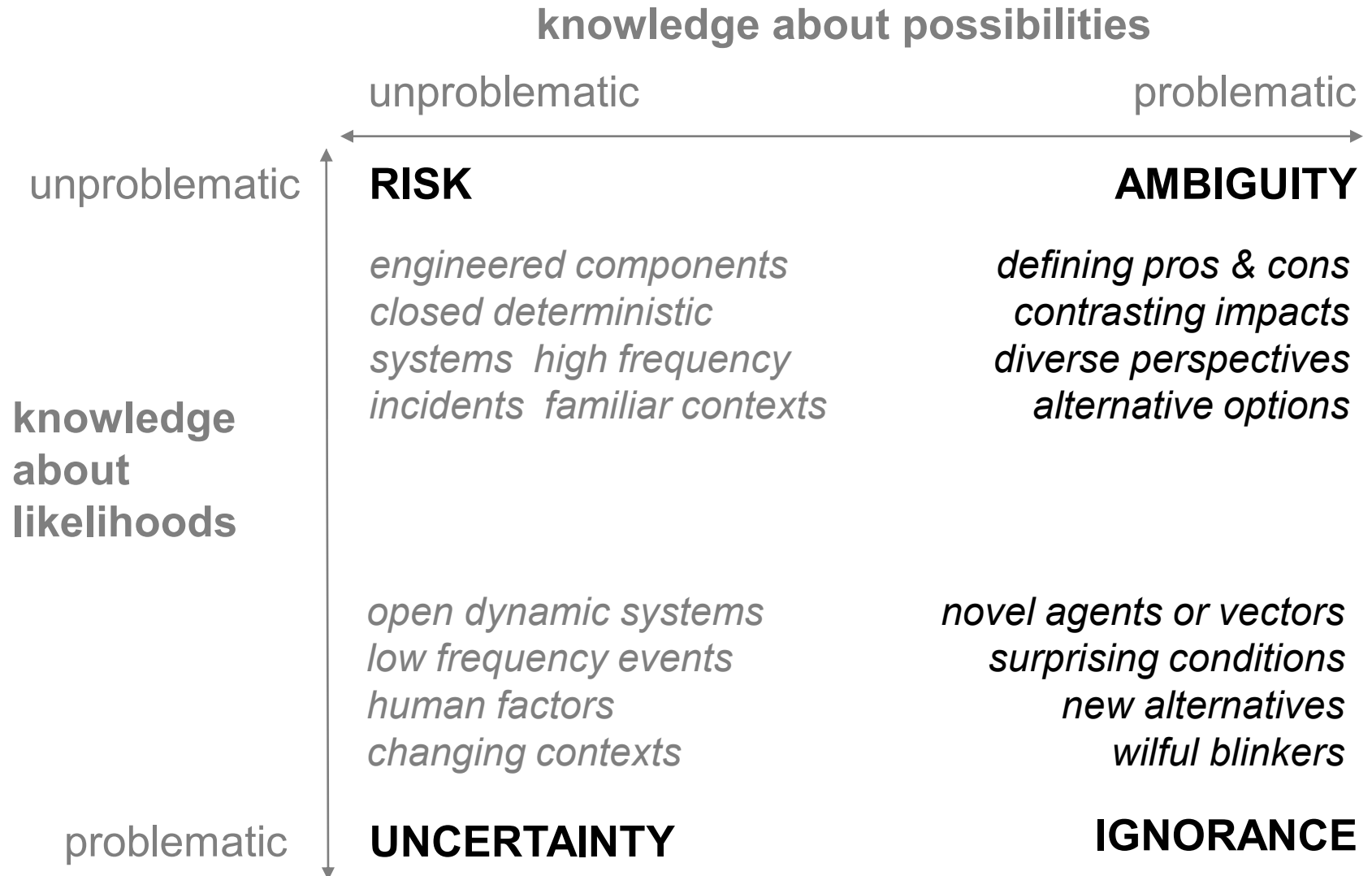
Beyond Risk

contrasting aspects of 'incertitude'



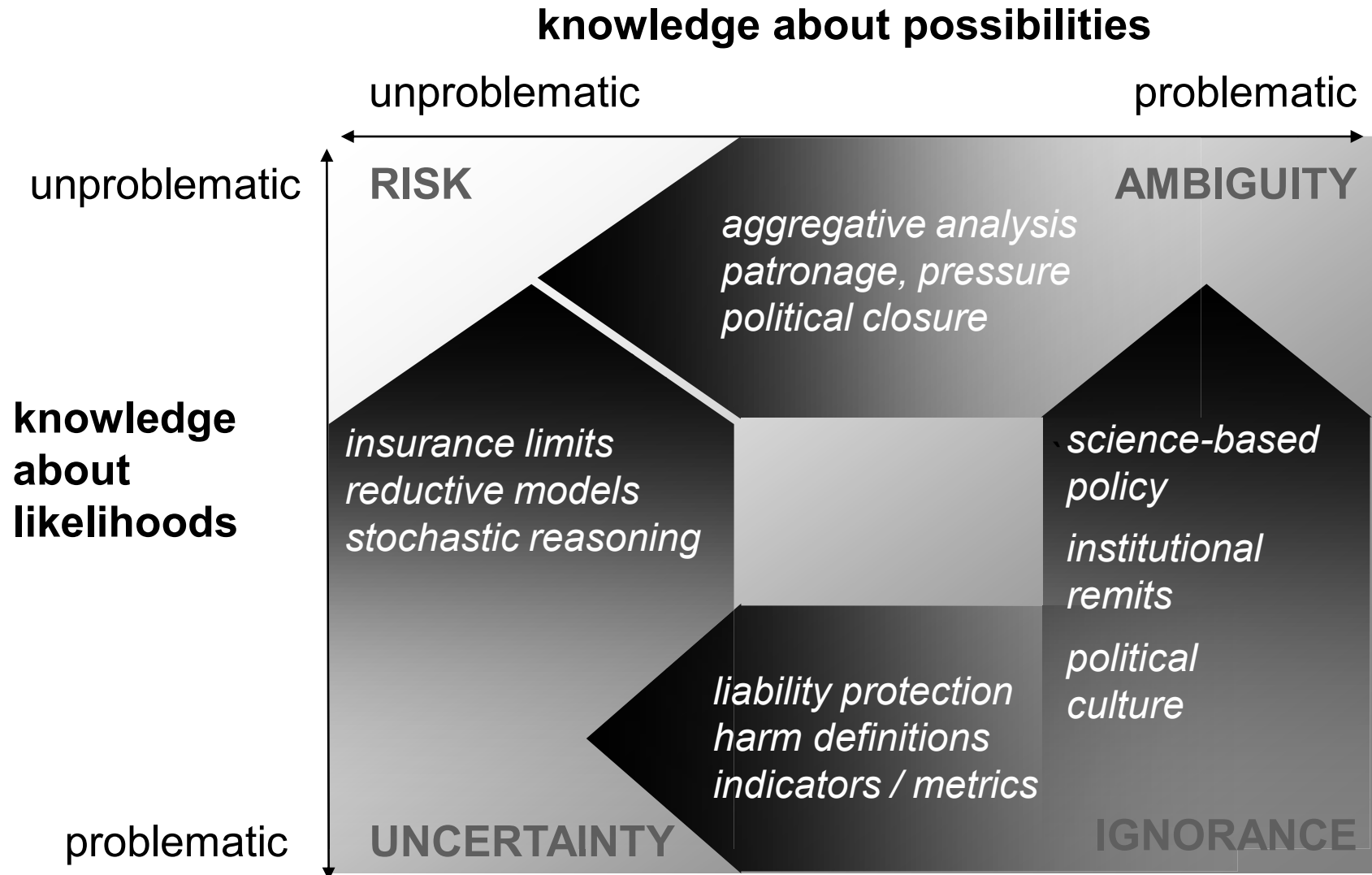
Beyond Risk

contrasting aspects of 'incertitude'



Pressures for Closure

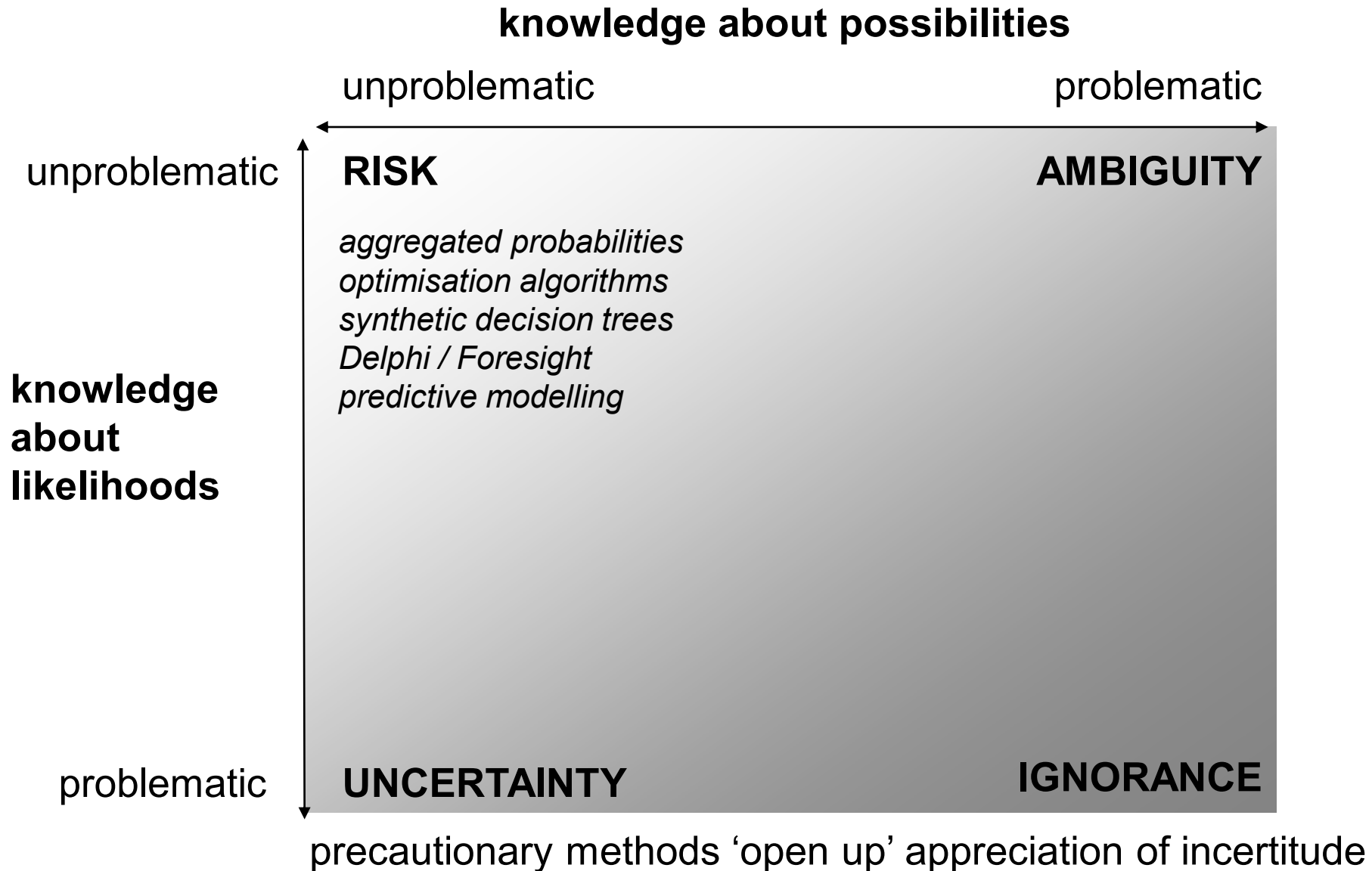
institutional drivers of risk assessment



risk focus is shaped by power – Beck’s “organised irresponsibility”

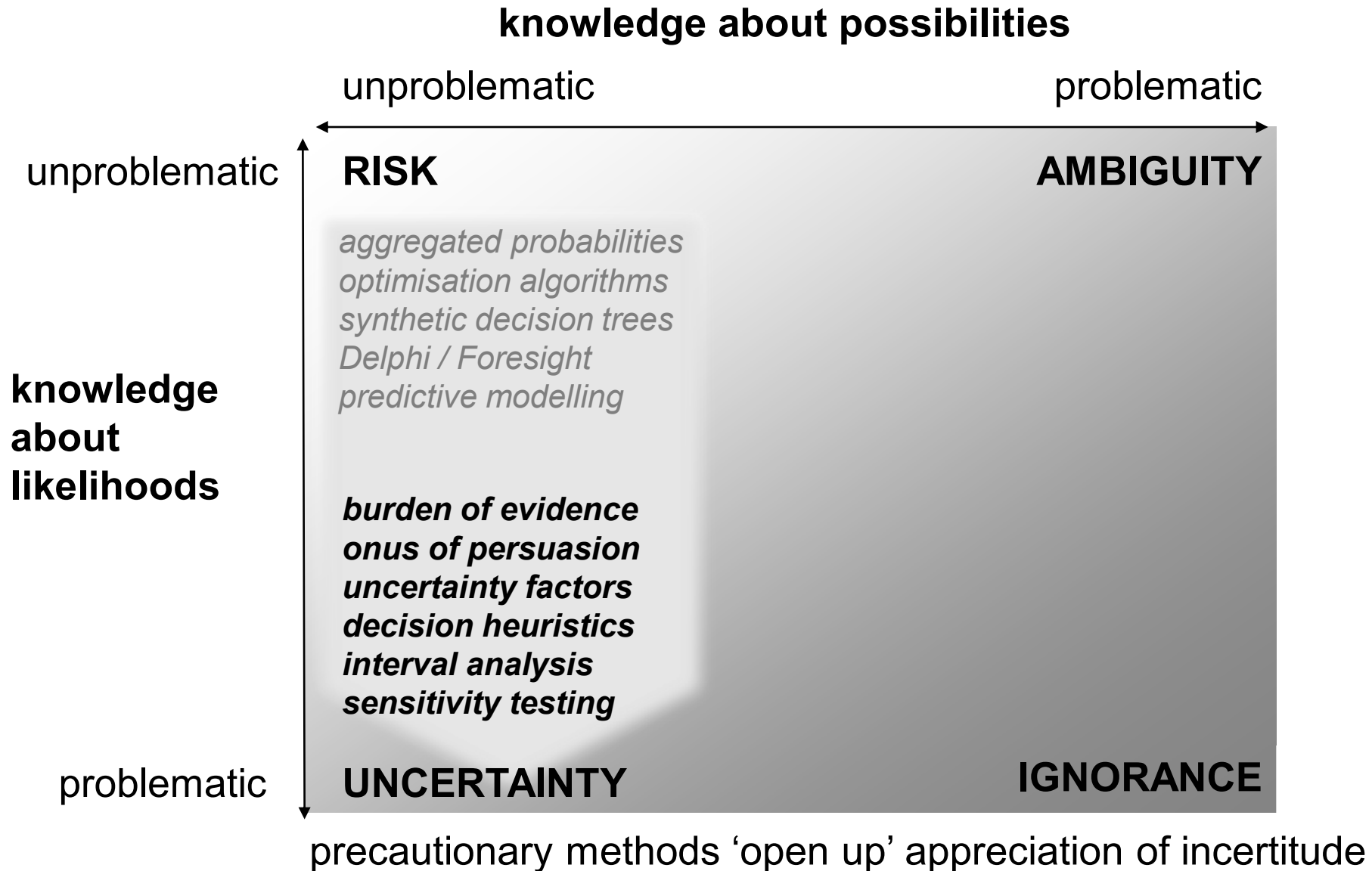
Methods for 'Opening Up'

precaution and participation are about rigour



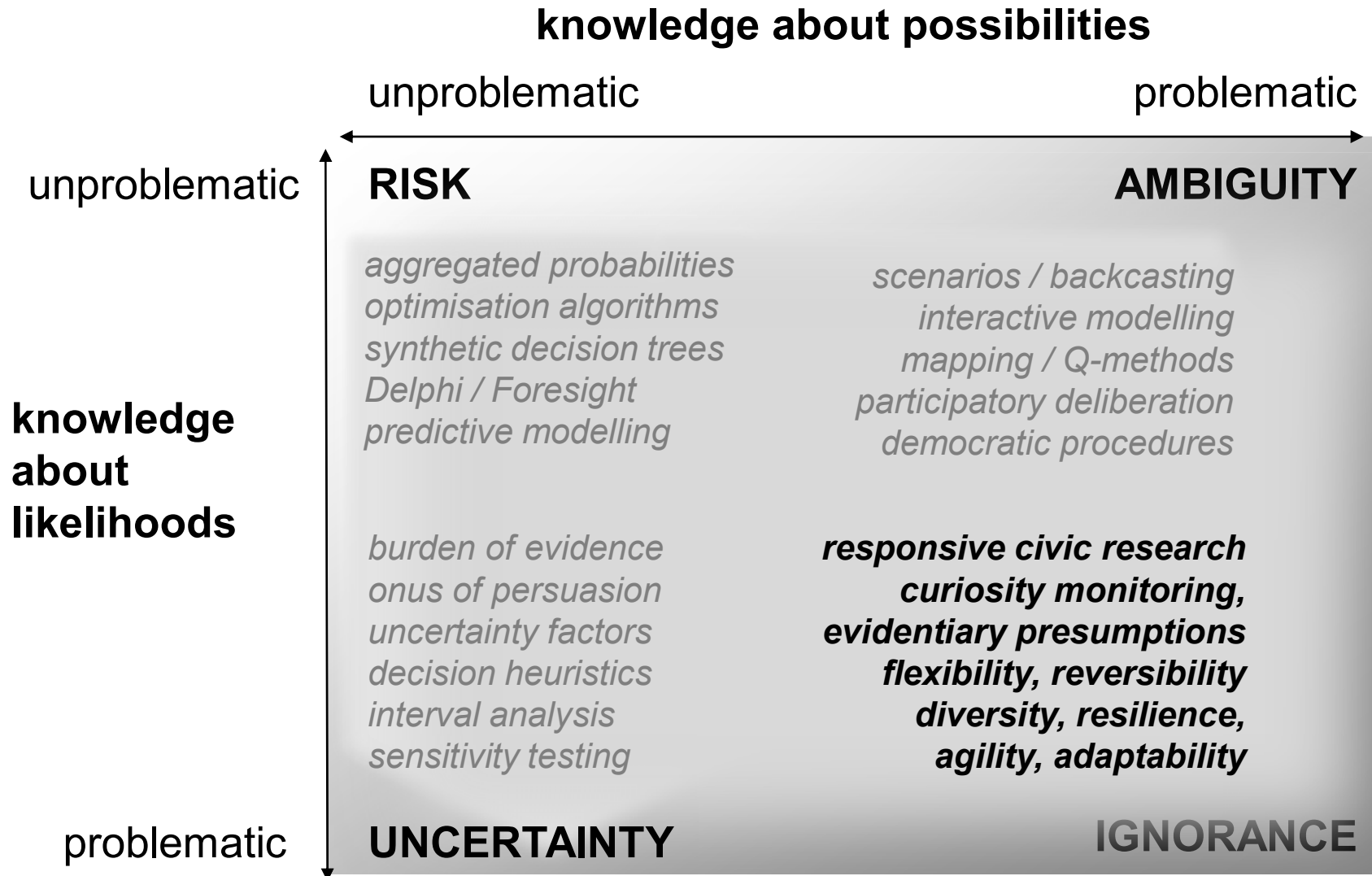
Methods for 'Opening Up'

precaution and participation are about rigour



Methods for 'Opening Up'

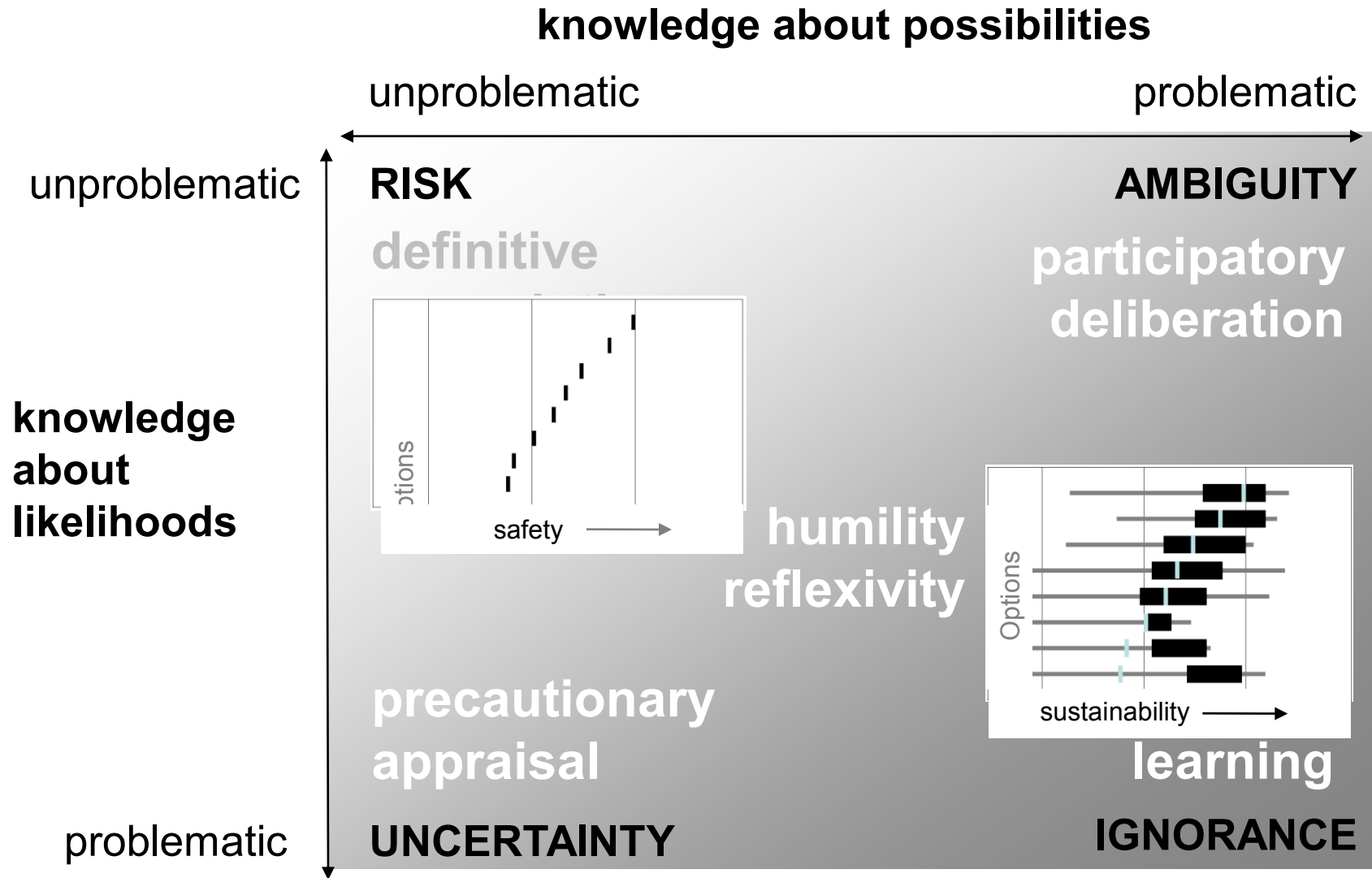
precaution and participation are about rigour



precautionary methods 'open up' appreciation of uncertainty

'Opening Up' Incertitude

precaution and participation are about rigour



'opening up': options, issues, approaches, possibilities, perspectives

Precaution, Participation, Adaptive Learning (cf: EEA, 2001)

From narrow 'decision rules' to broad-based 'deliberative process'

extend scope

additive, cumulative, synergistic effects; life cycles, compliance
real world effects: closed systems': MTBE PCBs, DES; '

Precaution, Participation, Adaptive Learning (cf: EEA, 2001)

From narrow 'decision rules' to broad-based 'deliberative process'

extend scope additive, cumulative, synergistic effects; life cycles, compliance

;

explicit incertitude explicitly engage with uncertainty, ambiguity and ignorance
reduction to risk: CFCs, EDCs, GMOs,

Precaution, Participation, Adaptive Learning (cf: EEA, 2001)

From narrow 'decision rules' to broad-based 'deliberative process'

- extend scope** additive, cumulative, synergistic effects; life cycles, compliance
- explicit incertitude** explicitly engage with uncertainty, ambiguity and ignorance
- humility on science** sensitivities & proxies: mobility, persistence, bioaccumulation
omission of persistence in organochlorines, MTBE, CFCs

Precaution, Participation, Adaptive Learning (cf: EEA, 2001)

From narrow 'decision rules' to broad-based 'deliberative process'

extend scope additive, cumulative, synergistic effects; life cycles, compliance

,
'

explicit incertitude explicitly engage with uncertainty, ambiguity and ignorance

,

humility on science sensitivities & proxies: mobility, persistence, bioaccumulation

pro-active research prioritise open monitoring & surveillance & targeted experiment
neglected monitoring: TBT, BSE; asbestos, benzene, PCBs

Precaution, Participation, Adaptive Learning (cf: EEA, 2001)

From narrow 'decision rules' to broad-based 'deliberative process'

extend scope additive, cumulative, synergistic effects; life cycles, compliance

,
'

explicit incertitude explicitly engage with uncertainty, ambiguity and ignorance

,

humility on science sensitivities & proxies: mobility, persistence, bioaccumulation

pro-active research prioritise open monitoring & surveillance & targeted experiment

deliberate argument levels of proof, burden of evidence, onus of persuasion
Swann Committee on antimicrobials, 1967 later ignored

Precaution, Participation, Adaptive Learning (cf: EEA, 2001)

From narrow 'decision rules' to broad-based 'deliberative process'

extend scope	additive, cumulative, synergistic effects; life cycles, compliance
explicit incertitude	explicitly engage with uncertainty, ambiguity and ignorance
humility on science	sensitivities & proxies: mobility, persistence, bioaccumulation
pro-active research	prioritise open monitoring & surveillance & targeted experiment
deliberate argument	levels of proof, burden of evidence, onus of persuasion
alternative options	pros, cons, justifications for range of options & substitutes <i>ALARA, BAT, BPM – ionising radiation, fisheries, acid rain</i>

Precaution, Participation, Adaptive Learning (cf: EEA, 2001)

From narrow 'decision rules' to broad-based 'deliberative process'

extend scope	additive, cumulative, synergistic effects; life cycles, compliance , ' ,
explicit incertitude	explicitly engage with uncertainty, ambiguity and ignorance ,
humility on science	sensitivities & proxies: mobility, persistence, bioaccumulation
pro-active research	prioritise open monitoring & surveillance & targeted experiment
deliberate argument	levels of proof, burden of evidence, onus of persuasion
alternative options	pros, cons, justifications for range of options & substitutes
transdisciplinarity	collect all relevant knowledge, beyond 'usual suspects' <i>MTBE / engineers; BSE / vets (clinical / toxicology / epidem.)</i>

Precaution, Participation, Adaptive Learning (cf: EEA, 2001)

From narrow 'decision rules' to broad-based 'deliberative process'

extend scope additive, cumulative, synergistic effects; life cycles, compliance

explicit incertitude explicitly engage with uncertainty, ambiguity and ignorance

humility on science sensitivities & proxies: mobility, persistence, bioaccumulation

pro-active research prioritise open monitoring & surveillance & targeted experiment

deliberate argument levels of proof, burden of evidence, onus of persuasion

alternative options pros, cons, justifications for range of options & substitutes

transdisciplinarity collect all relevant knowledge, beyond 'usual suspects'

engage public independence through pluralism and robustness on values
benzene, DES, asbestos, acid rain, fisheries

Precaution, Participation, Adaptive Learning (cf: EEA, 2001)

From narrow 'decision rules' to broad-based 'deliberative process'

extend scope	additive, cumulative, synergistic effects; life cycles, compliance
explicit incertitude	explicitly engage with uncertainty, ambiguity and ignorance
humility on science	sensitivities & proxies: mobility, persistence, bioaccumulation
pro-active research	prioritise open monitoring & surveillance & targeted experiment
deliberate argument	levels of proof, burden of evidence, onus of persuasion
alternative options	pros, cons, justifications for range of options & substitutes
transdisciplinarity	collect all relevant knowledge, beyond 'usual suspects'
engage public	independence through pluralism and robustness on values
'open up' politics	'plural conditional' (not unitary definitive) inputs to policy debate <i>'GM' (trans / syn / MAB), 'low carbon' (nuclear / CCS / renews)</i>

Precaution, Participation, Adaptive Learning (cf: EEA, 2001)

From narrow 'decision rules' to broad-based 'deliberative process'

extend scope additive, cumulative, synergistic effects; life cycles, compliance

explicit incertitude explicitly engage with uncertainty, ambiguity and ignorance

humility on science sensitivities & proxies: mobility, persistence, bioaccumulation

pro-active research prioritise open monitoring & surveillance & targeted experiment

deliberate argument levels of proof, burden of evidence, onus of persuasion

alternative options pros, cons, justifications for range of options & substitutes

transdisciplinarity collect all relevant knowledge, beyond 'usual suspects'

engage public independence through pluralism and robustness on values

'open up' politics 'plural conditional' (not unitary definitive) inputs to policy debate

Plural Conditional Advice

Risks of different agricultural strategies

under assumptions of selection of UK expert policy advisers

organic

environmental

intensive

GM + labelling

GM + monitoring

GM + voluntary controls

Plural Conditional Advice

Risks of different agricultural strategies

under assumptions of selection of UK expert policy advisers

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



high risk low

A horizontal double-headed arrow is positioned below the text 'high', 'risk', and 'low'. The arrow points from 'high' on the left to 'low' on the right, with the word 'risk' centered above it, indicating a scale of risk.

Plural Conditional Advice

Risks of different agricultural strategies

under assumptions of selection of UK expert policy advisers

GOVERNMENT



high risk low

Plural Conditional Advice

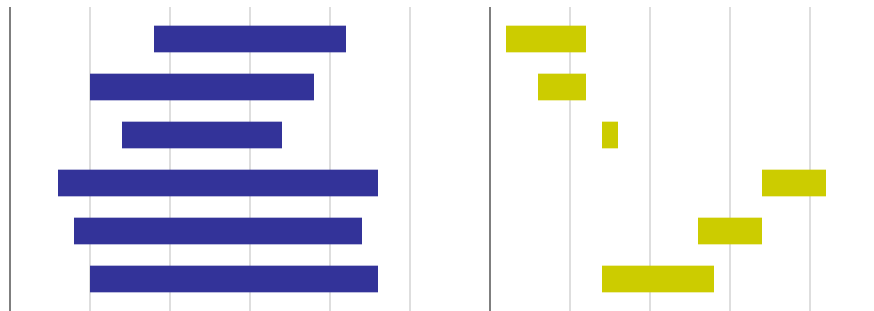
Risks of different agricultural strategies

under assumptions of selection of UK expert policy advisers

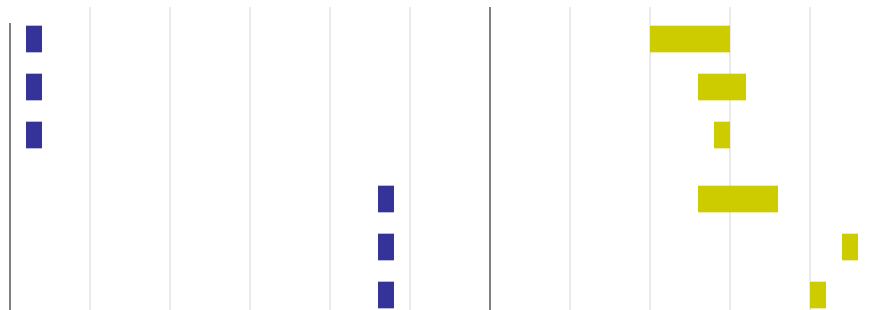
GOVERNMENT

INDUSTRY

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



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



high

risk

low



Plural Conditional Advice

Risks of different agricultural strategies

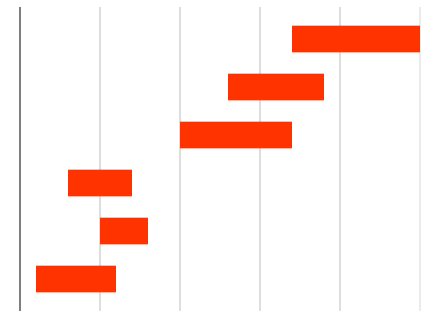
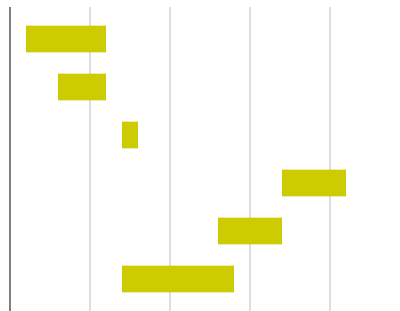
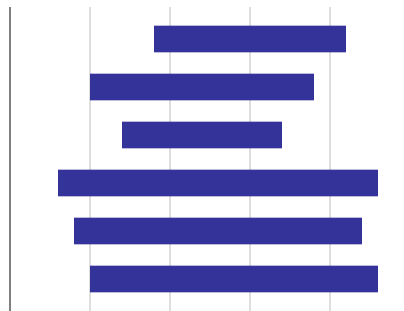
under assumptions of selection of UK expert policy advisers

GOVERNMENT

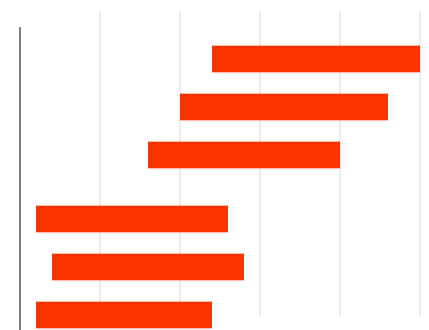
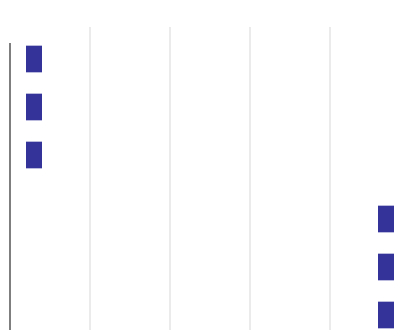
INDUSTRY

PUBLIC INTEREST

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



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



high risk low
←————→