University of Sussex

SPRU – Science & Technology Policy Research

STEPS centre

Multicriteria Appraisal in Mega Infrastructures:

some pros, cons and wider issues

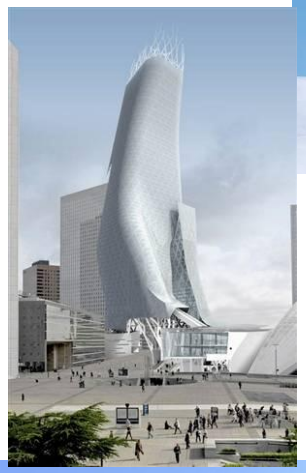
seminar presented at
OMEGA Centre, School of Planning, University College London,
Wednesday 9th February 2011

Andy Stirling
SPRU – science and technology policy research

Mega Infrastructure Choice

Many possible innovation pathways to ‘energy sustainability’:

- demand restructuring?
- behaviour change?
- efficient end use?
- service reform?
- renewable energy?
- carbon capture and storage?
- nuclear power?



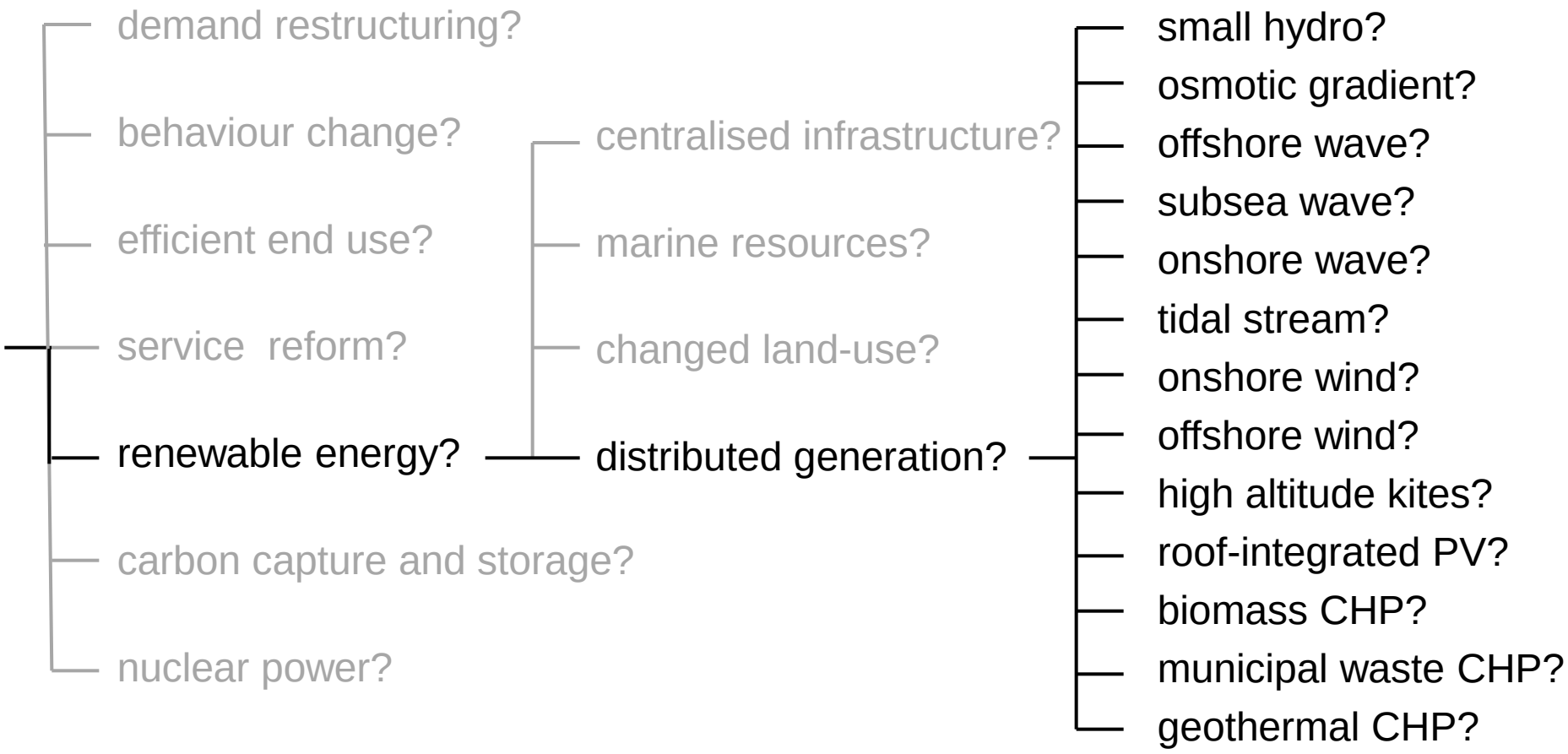
Mega Infrastructure Choice

Many possible innovation pathways to ‘energy sustainability’:

- demand restructuring?
- behaviour change?
- efficient end use?
- service reform?
- renewable energy?
  - centralised infrastructure?
  - marine resources?
  - changed land-use?
  - distributed generation?
- carbon capture and storage?
- nuclear power?

Mega Infrastructure Choice

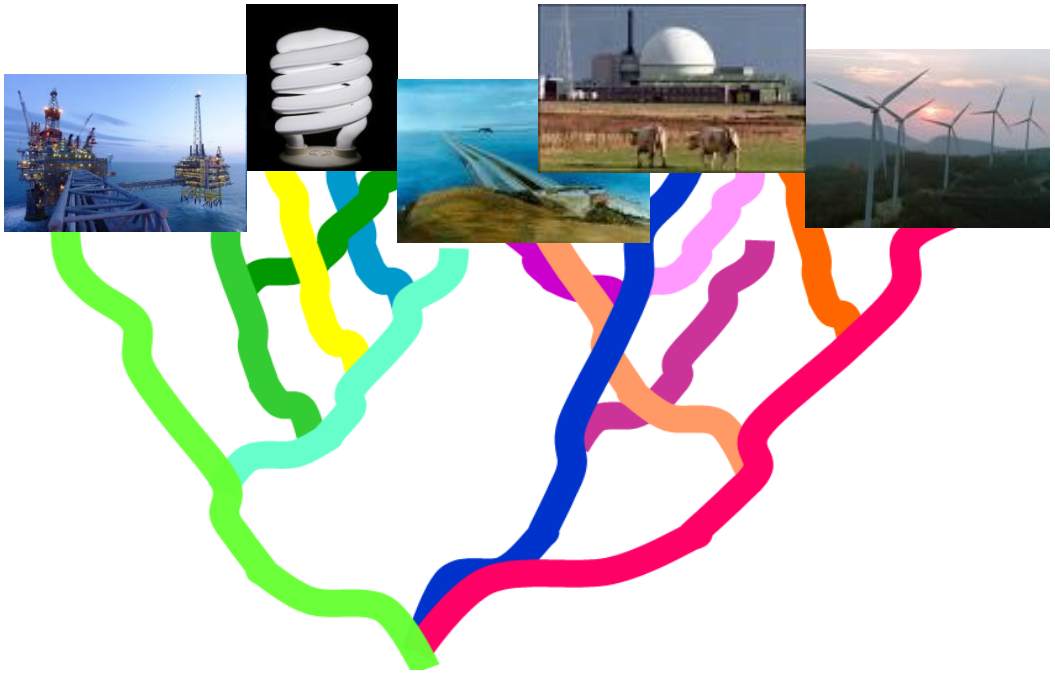
Many possible innovation pathways to 'energy sustainability':

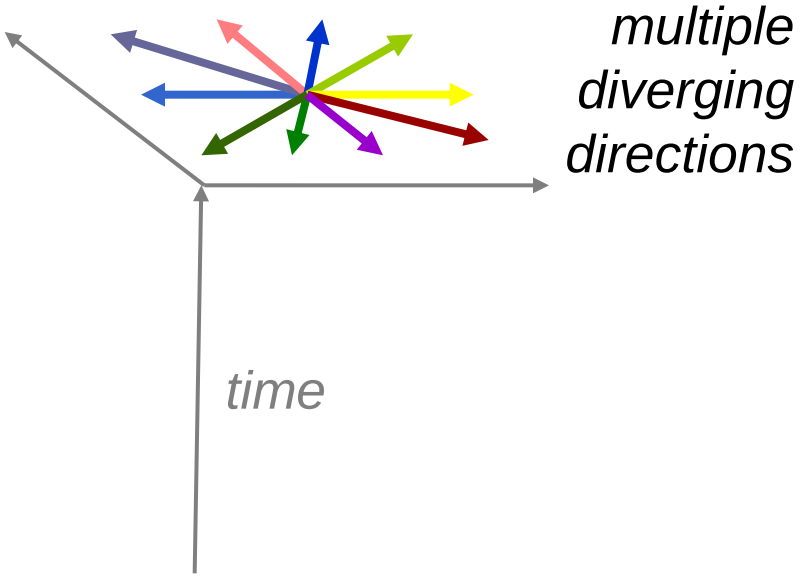


All physically **possible,** technically **feasible** and economically **viable** …

… but **not fully realisable** together, **especially in a globalised world**

Mega-Infrastructure ‘Lock-in’





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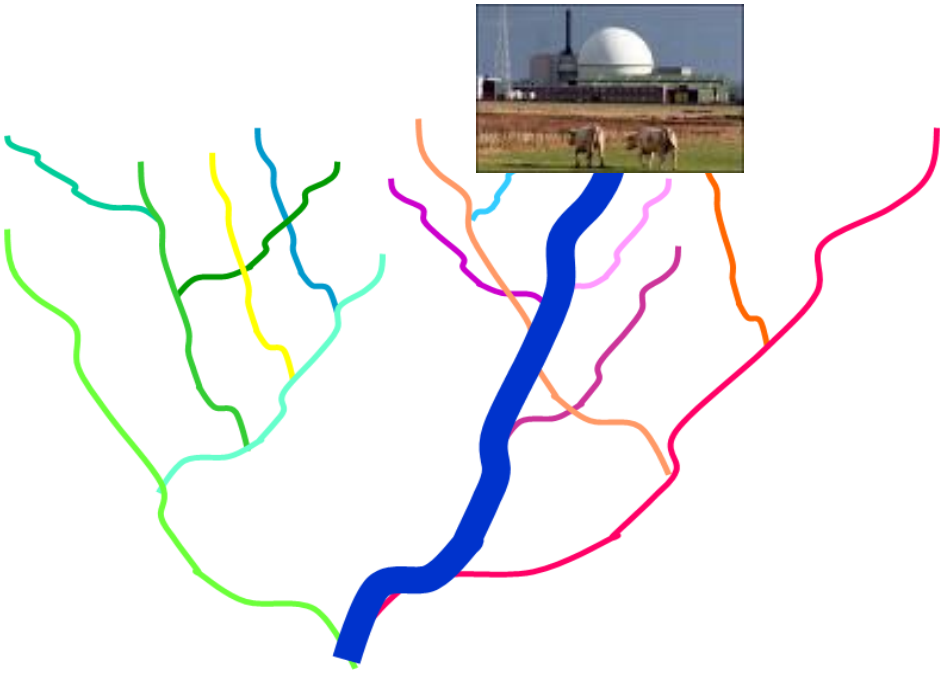
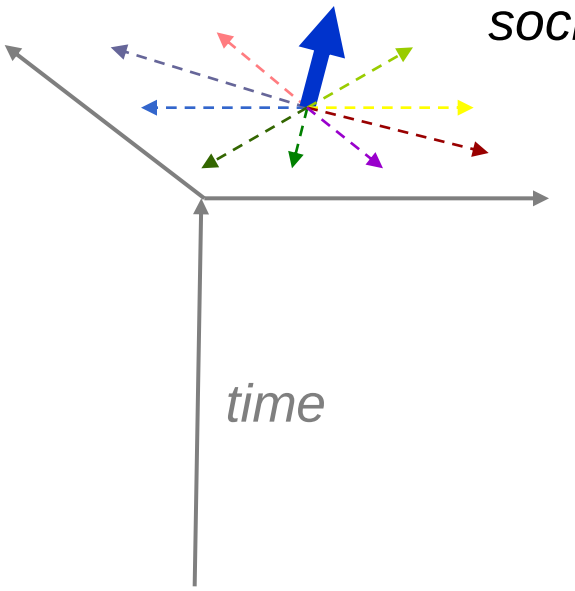




social imaginations and expectations

political ‘autonomy’ and ‘entrapment’

historical ‘momentum’ and ‘path dependency’

economic ‘trajectories’ and ‘lock-in’

‘Sound Science’ and Mega-Infrastuctures

food supply *“… this government's approach is to make decisions … on the basis of **sound science**”* *Tony Blair*

chemicals: “ …***sound science*** will be the basis of the Commission's legislative proposal…” *Philippe Busquin*

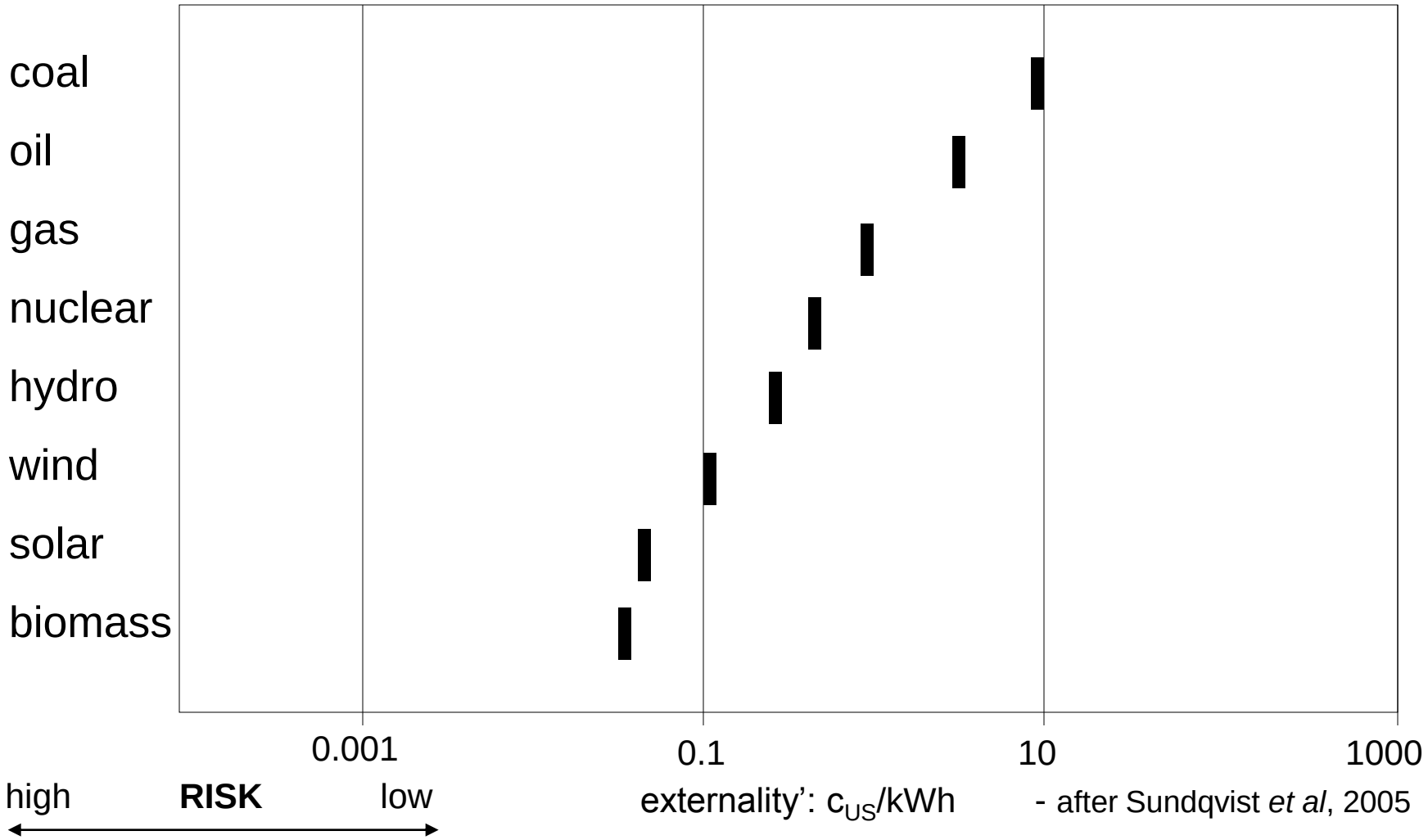
energy: *“cool-headed, evidence based assessment … sweep away **historic prejudice** and put in its place **evidence** and **science**”* *Malcolm Wicks*

military : *“*needs ... a ***properly objective*** and ***science-based decision***” *Peter Kilfoyle*

Reflect pressure: ‘justification’ *(Collingridge)*; ‘blame management’ *(Hood)*

‘Risks’ in Energy Infrastructures

Expert assessment appears to deliver precise orderings of options



- after Sundqvist *et al*, 2005

‘Risks’ in Energy Infrastructures

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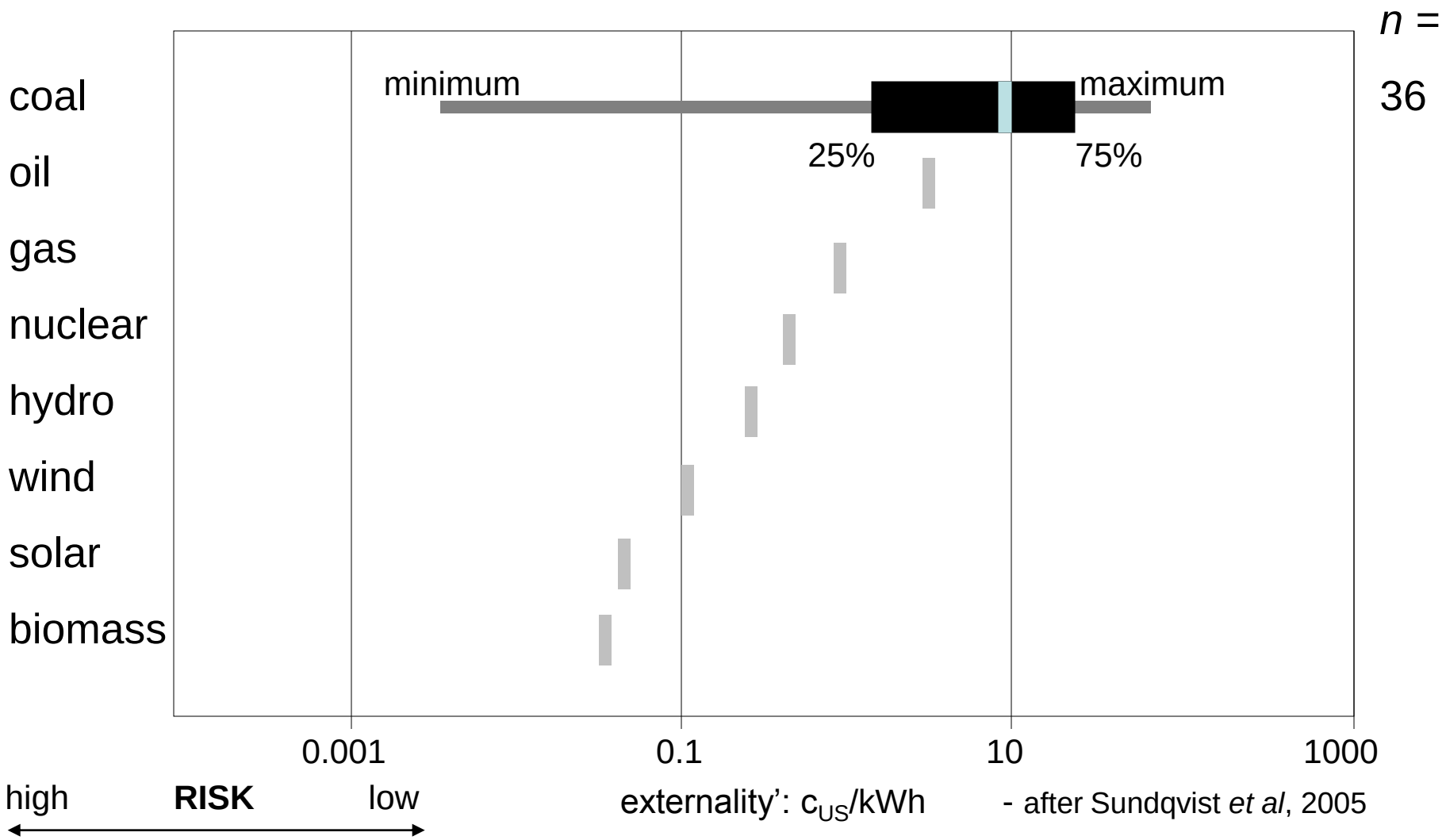
…but is sensitive to ‘framing’



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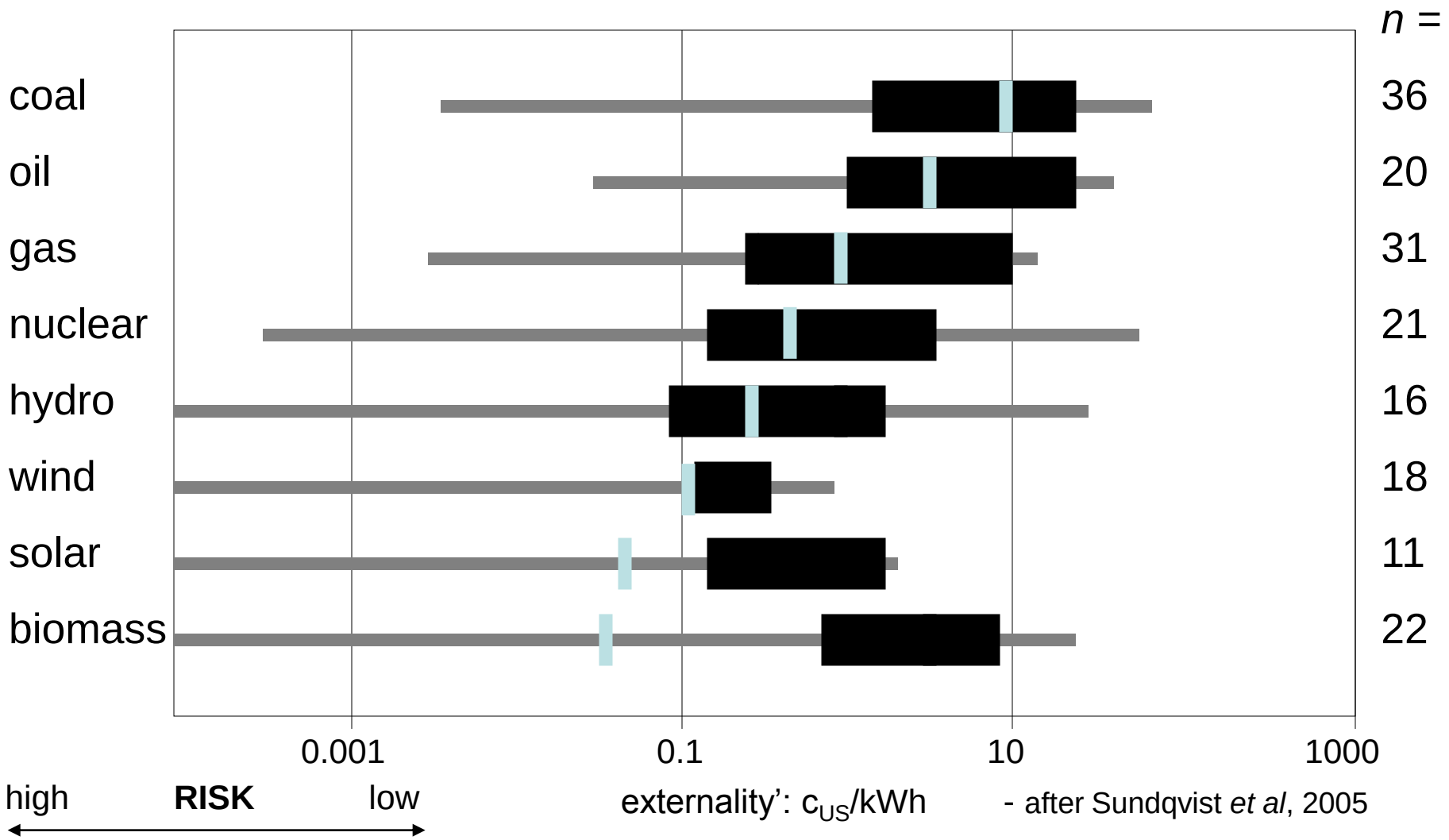


‘Framing’ in Analysis

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?’*

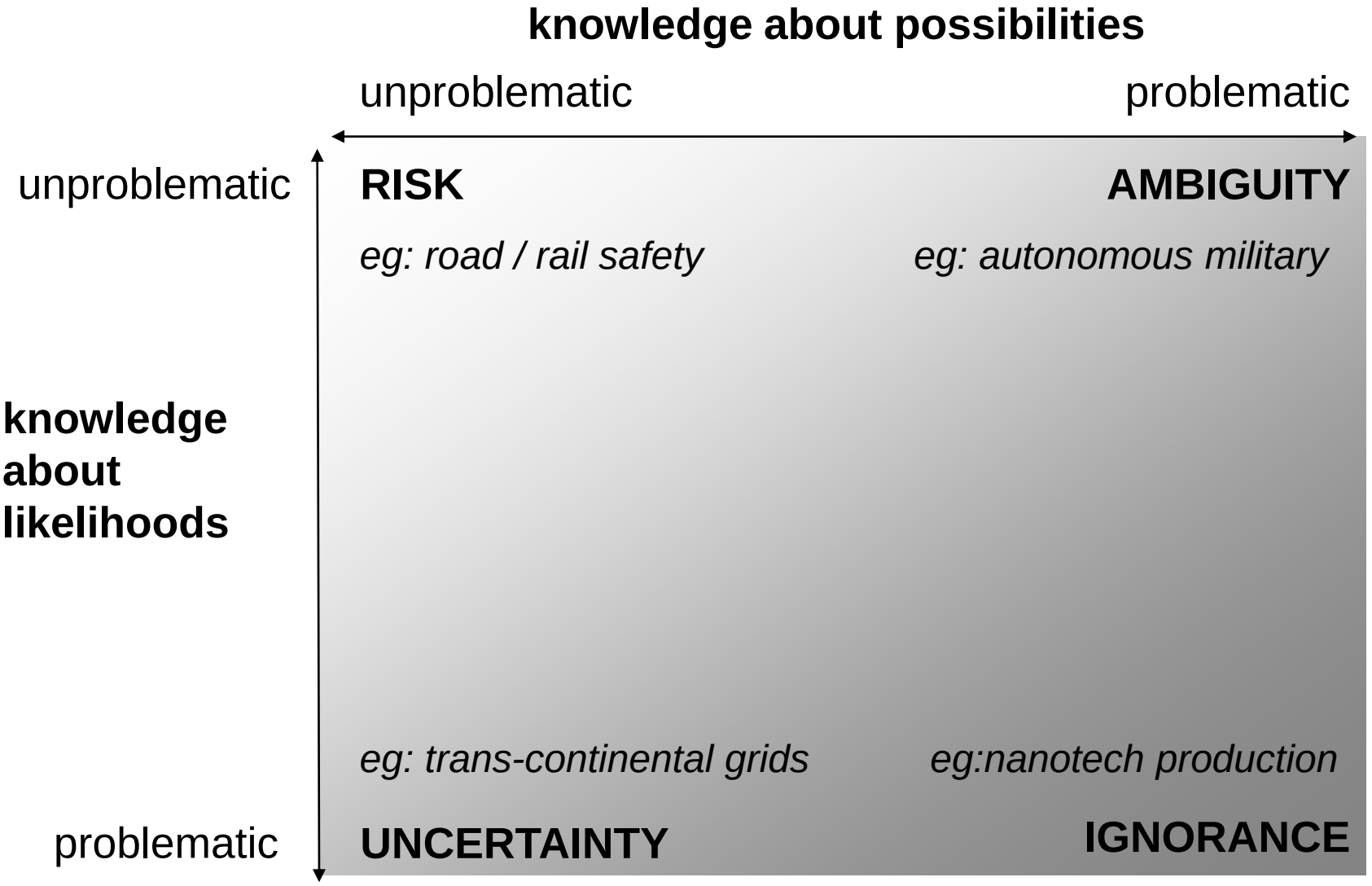
All analysis requires framing … all framing involves values

‘sound science’ and ‘evidence-base’ – different answers to different queries

… we should be as rigorous about validating the questions as the answers

Beyond ‘Risk’

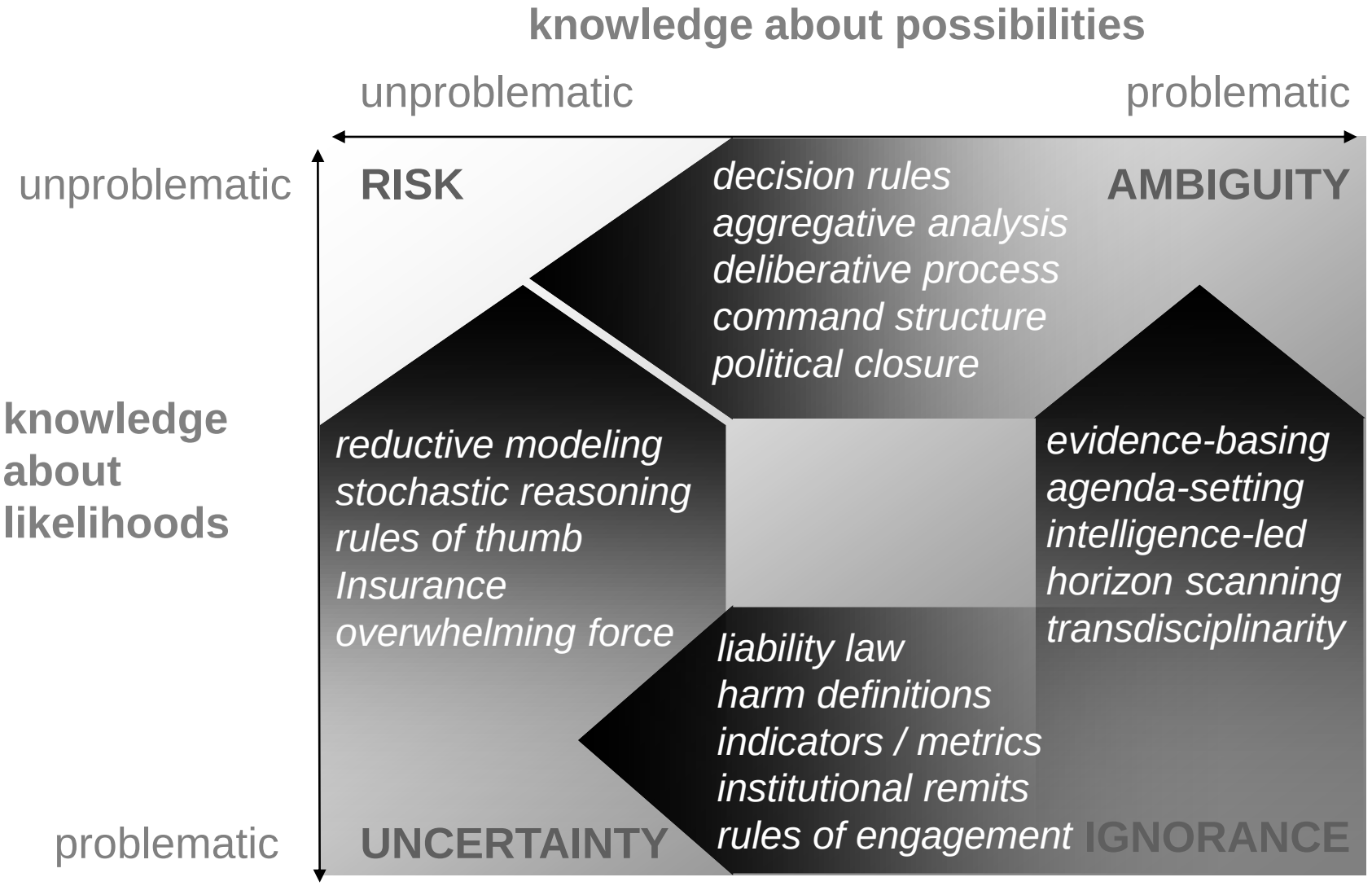
contrasting aspects of incomplete knowledge



- Knight, Keynes, Shackle, Collingridge, Smithson, Ravetz, Wynne ...

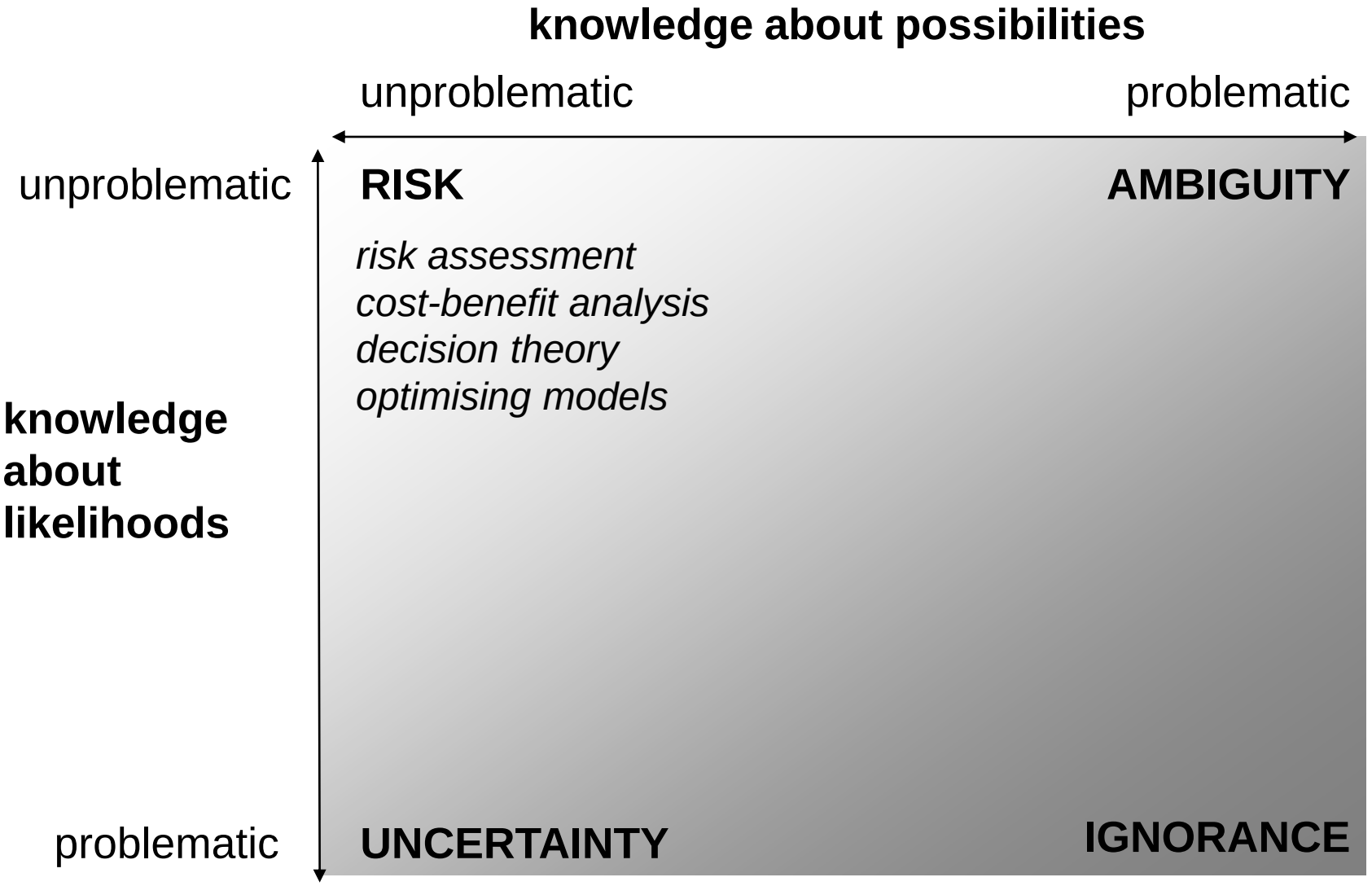
Power and Knowledge

Beck's "organised irresponsibility"



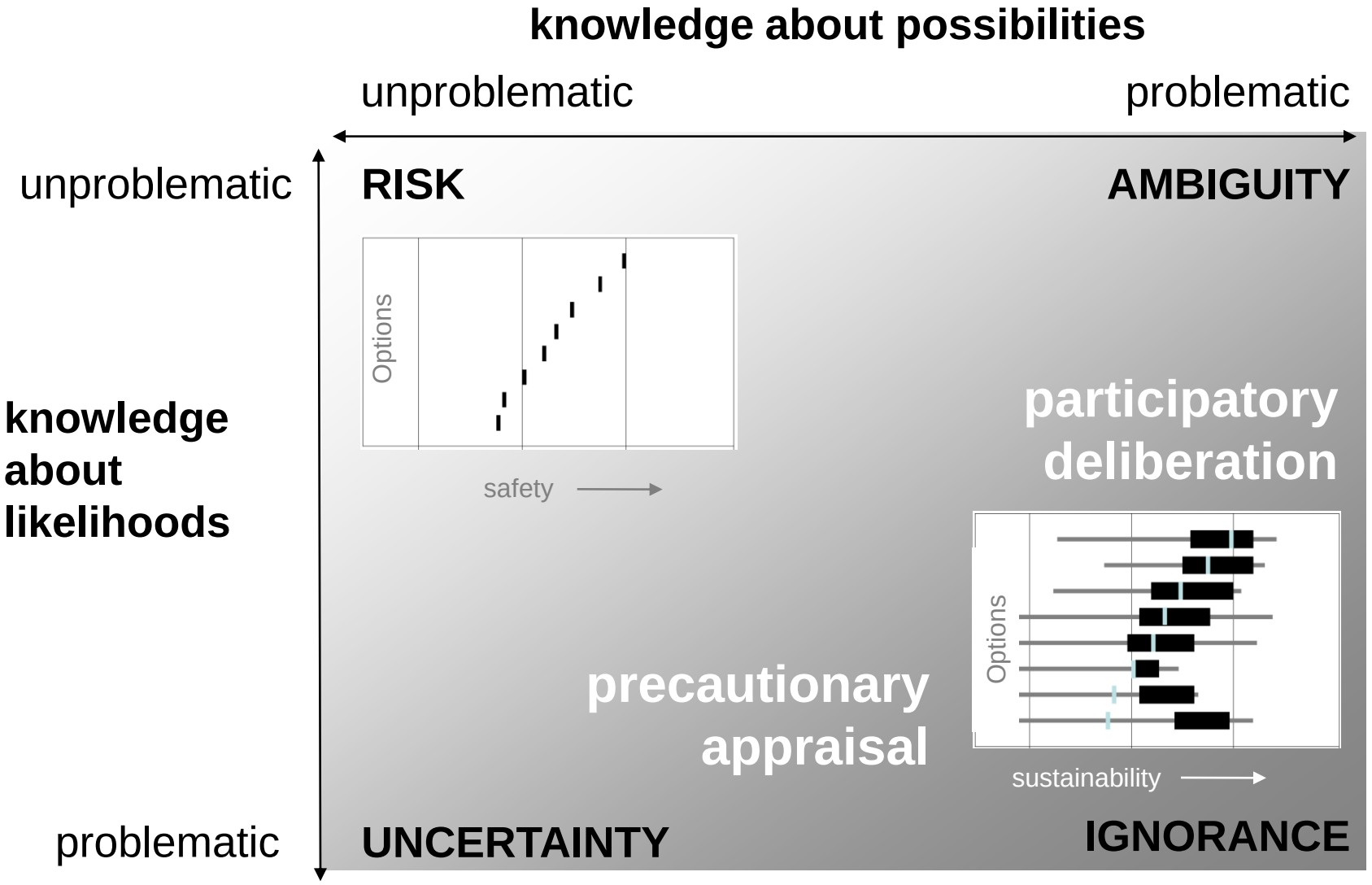
Power and Knowledge

resist institutional pressures by broadening out appraisal methods



From ‘Risk’ to Precaution

resist institutional pressures by broadening out appraisal methods



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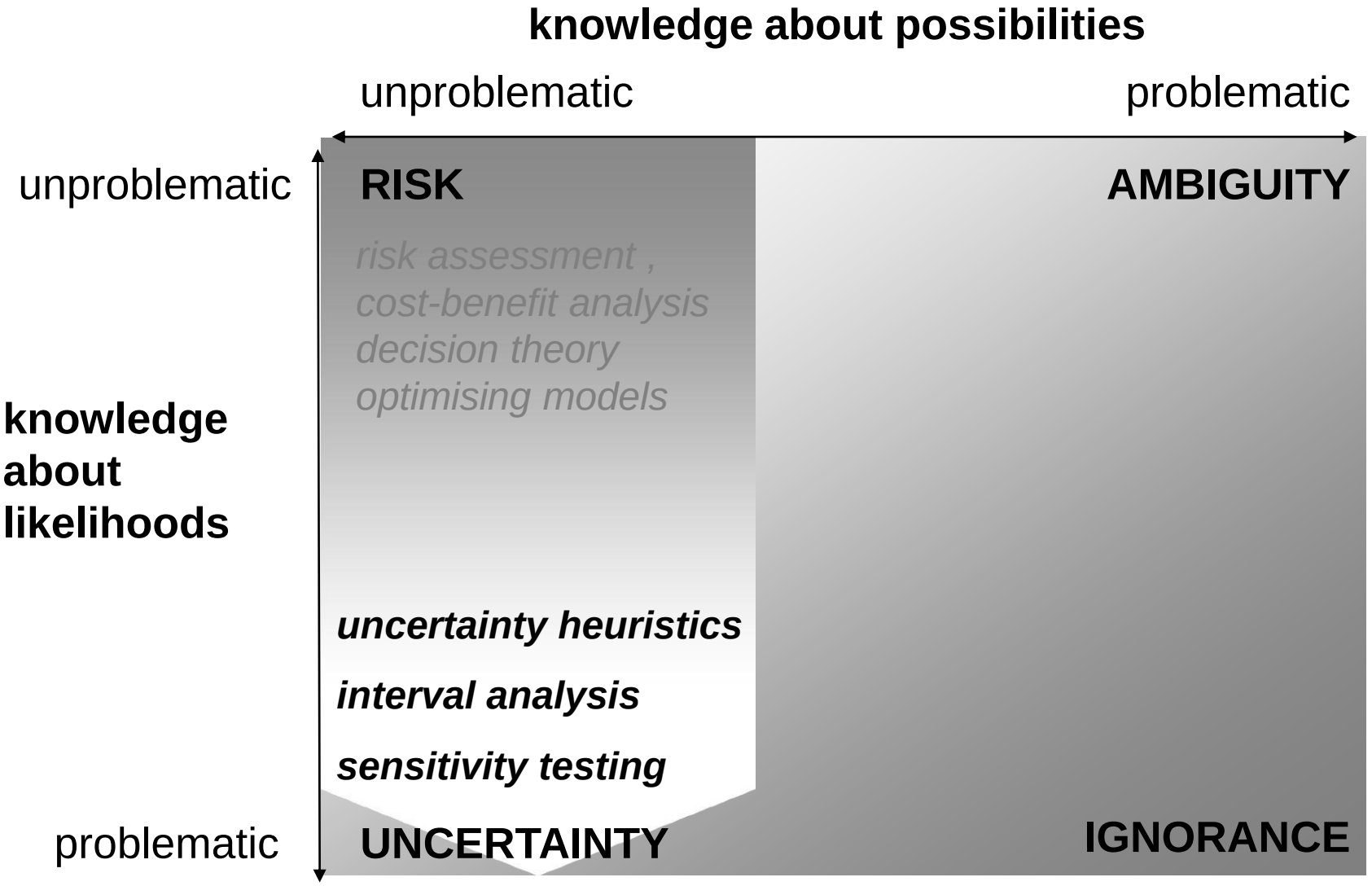

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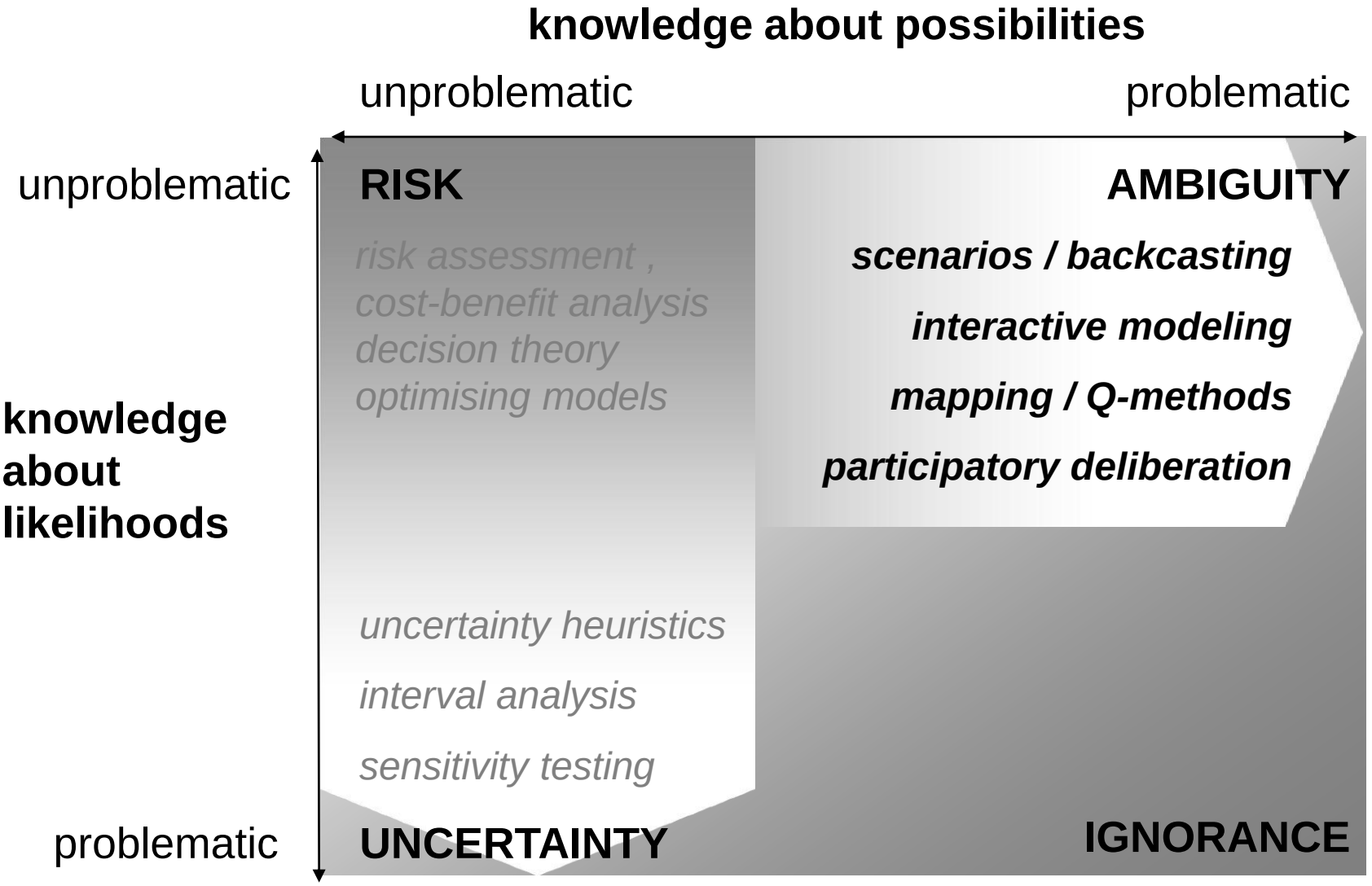

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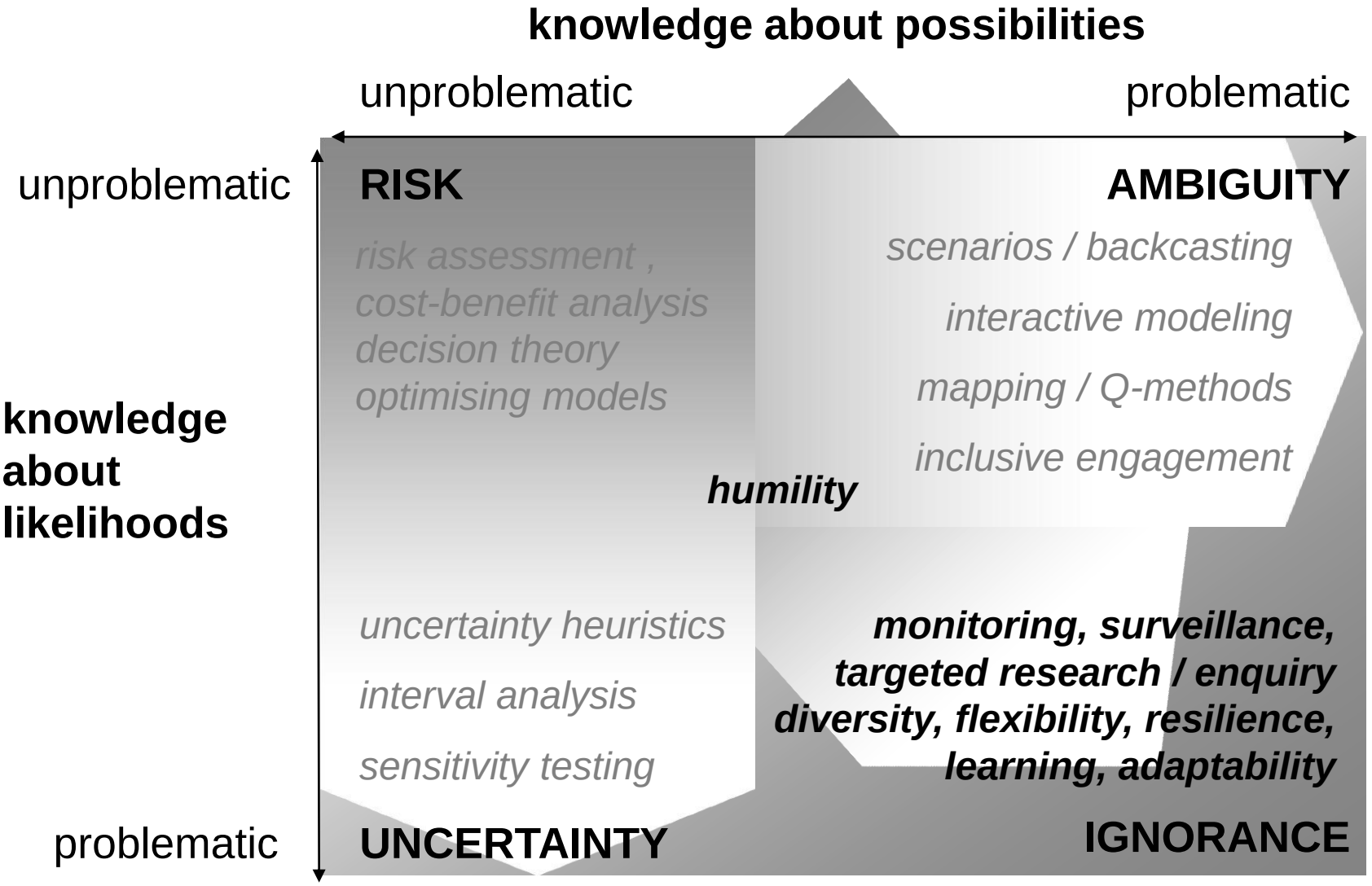


‘opening up’: options, issues, approaches, possibilities, perspectives

Potential of MCA

- **Values: openness to participation from multiple perspectives**
  eg: different disciplinary, stakeholder or public knowledges or viewpoints
- **Scores: principal technical and evaluative inputs are explicit**
  gives greater transparency to third parties
- **Multiple criteria: not constrained to use of single metric**
  eg: monetary value, mortality frequency
- **Examines benefits / justifications as well as costs / impacts**
- **Symmetrically compares a range of options, not one at a time**
- **Can catalyse broader iterative, reflective deliberation**

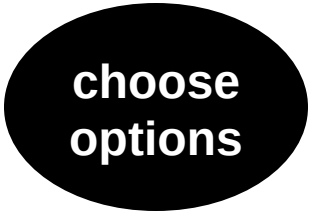
Problems of MCA

- **Participation and scope is often highly constrained**
- **Techniques can sometimes be very complex and opaque**
- **Often obscures full range of uncertainty and variability**
- **Assumes quantification not problematic**
- **Further assumes universality of utilitarian trade-offs**
- **Mechanically aggregates different perspectives**
- **Results typically presented as unitary prescriptions**

Elements of Multicriteria Mapping

Key Challenges in Policy Research / Appraisal	Response in MCM
What are the different possible courses of action?	- ‘options’
Which issues are relevant in appraising them?	- ‘criteria’
How do alternatives perform in relation to issues?	- ‘scores’
How uncertain or conditional are the associated pictures?	- ‘ranges’
What assumptions are made about ‘systems’ and ‘contexts’?	- ‘notes’
Are there any thresholds, ethical, non-quantifiable aspects?	- ‘principles’
What are the relative priorities and key trade-offs?	- ‘weights’

Multicriteria Mapping



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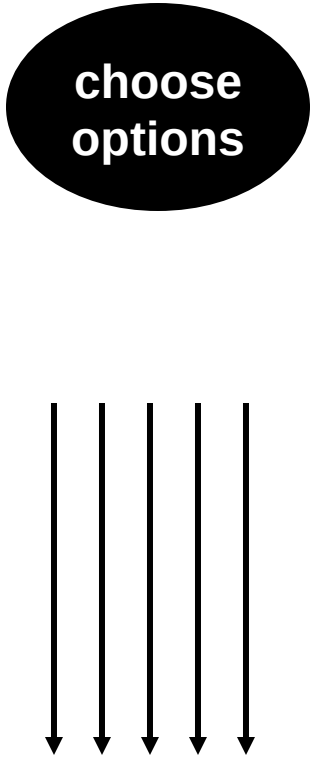

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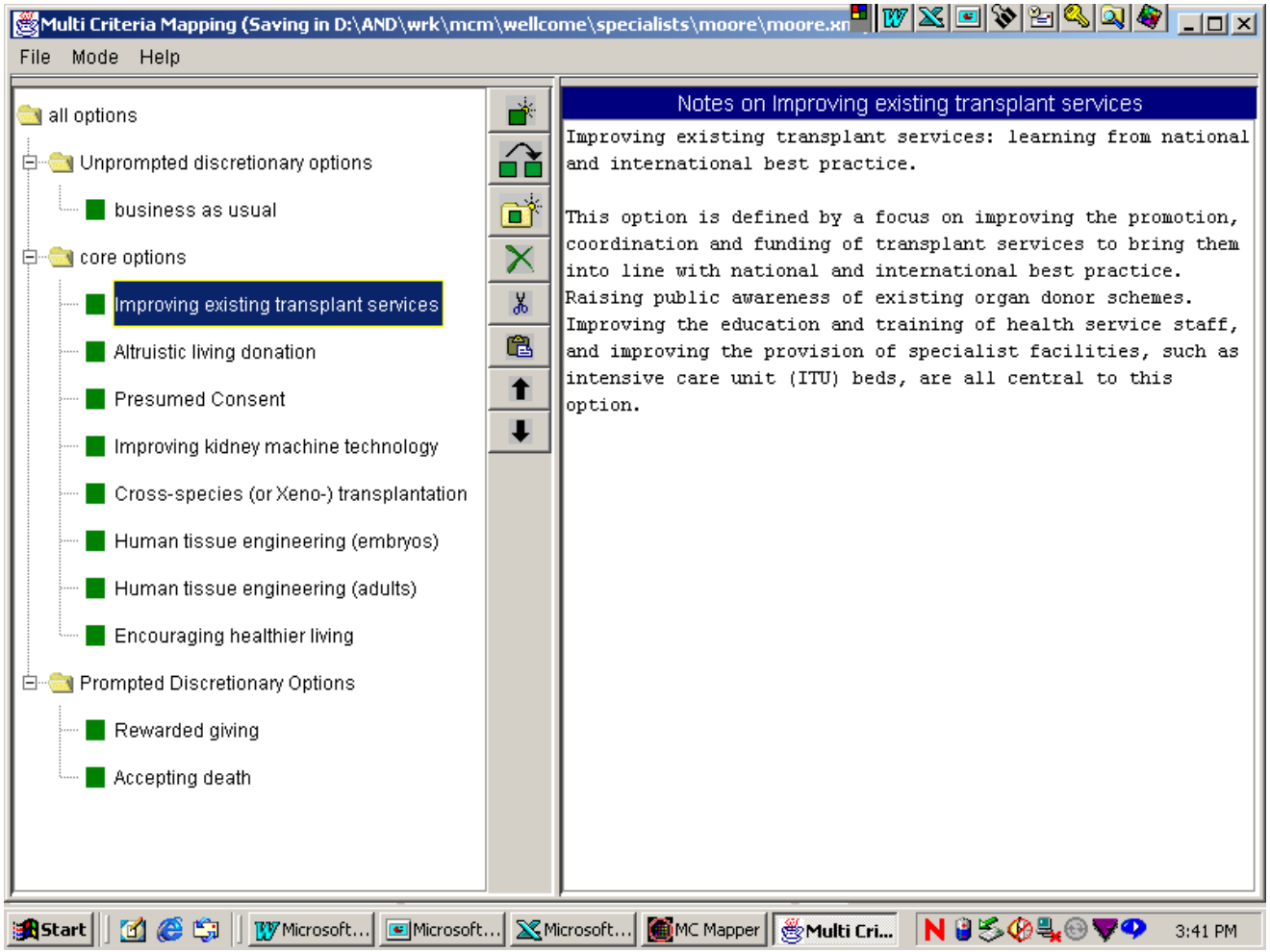

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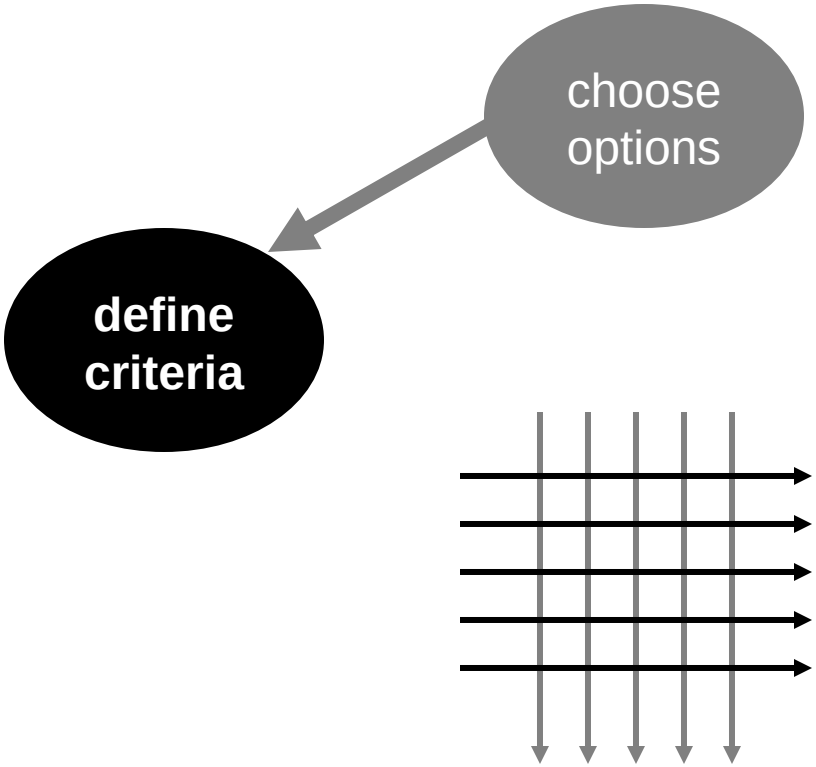

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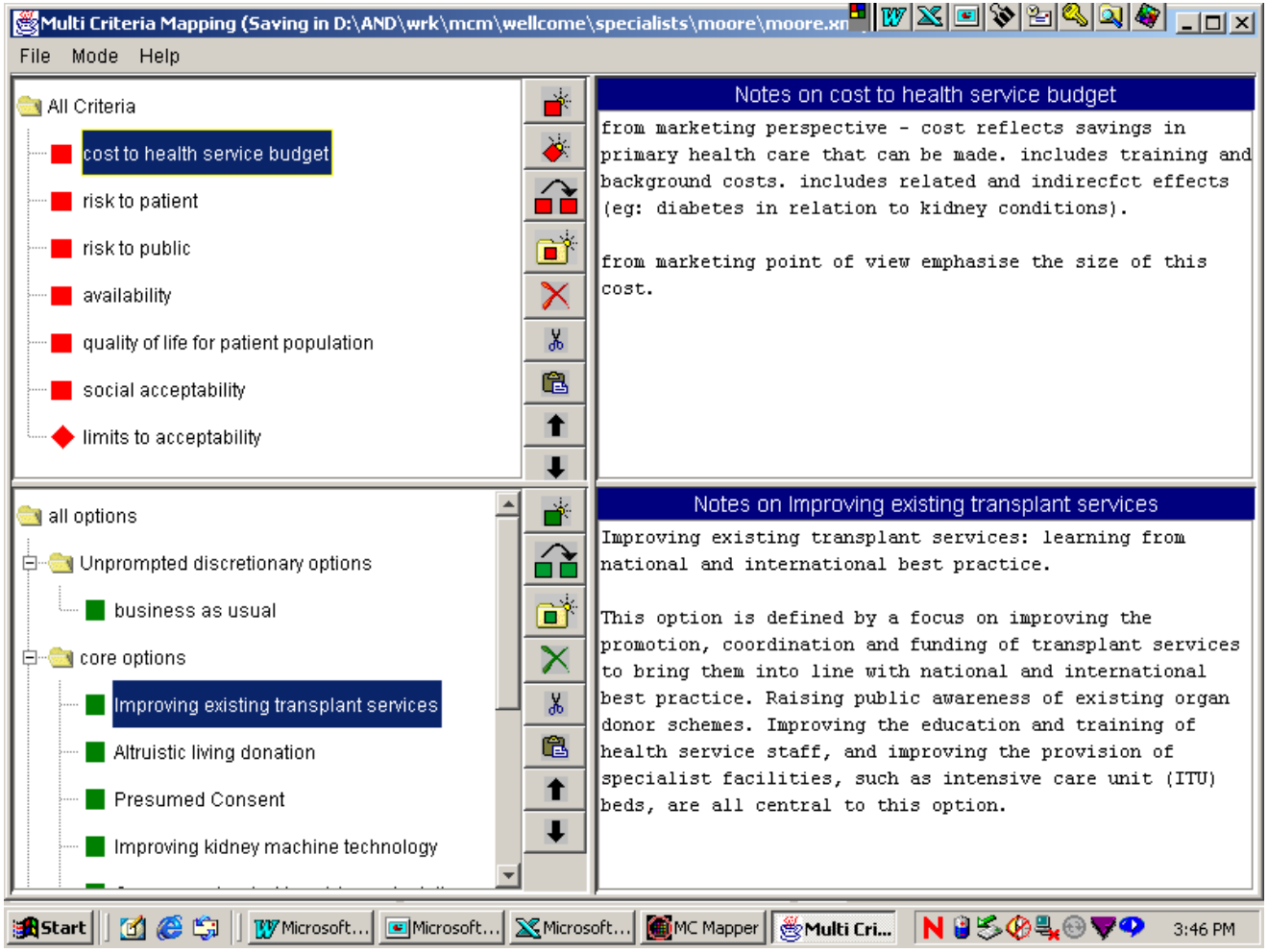

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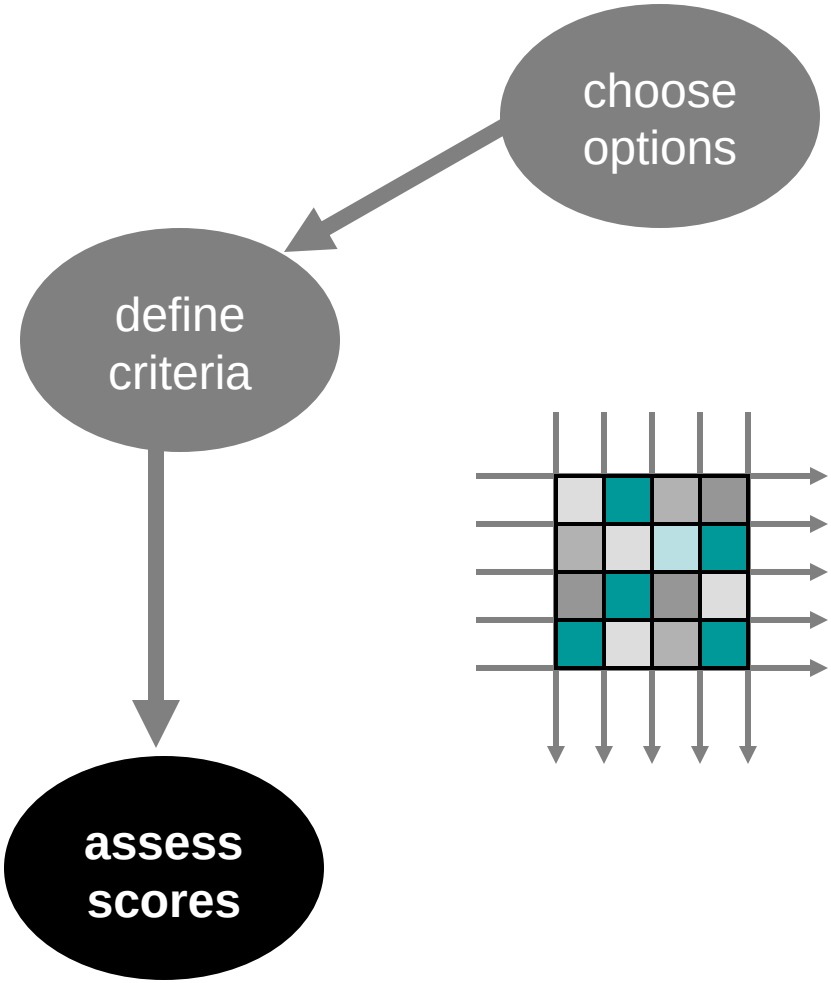

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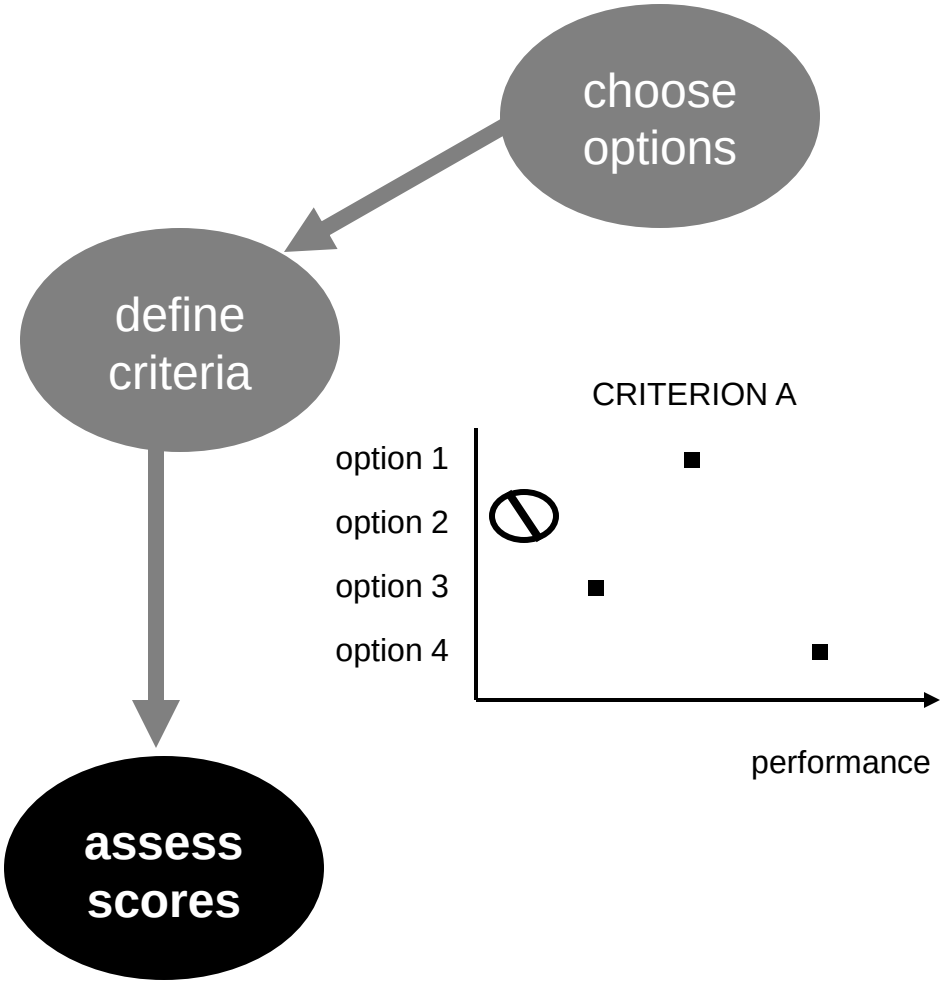

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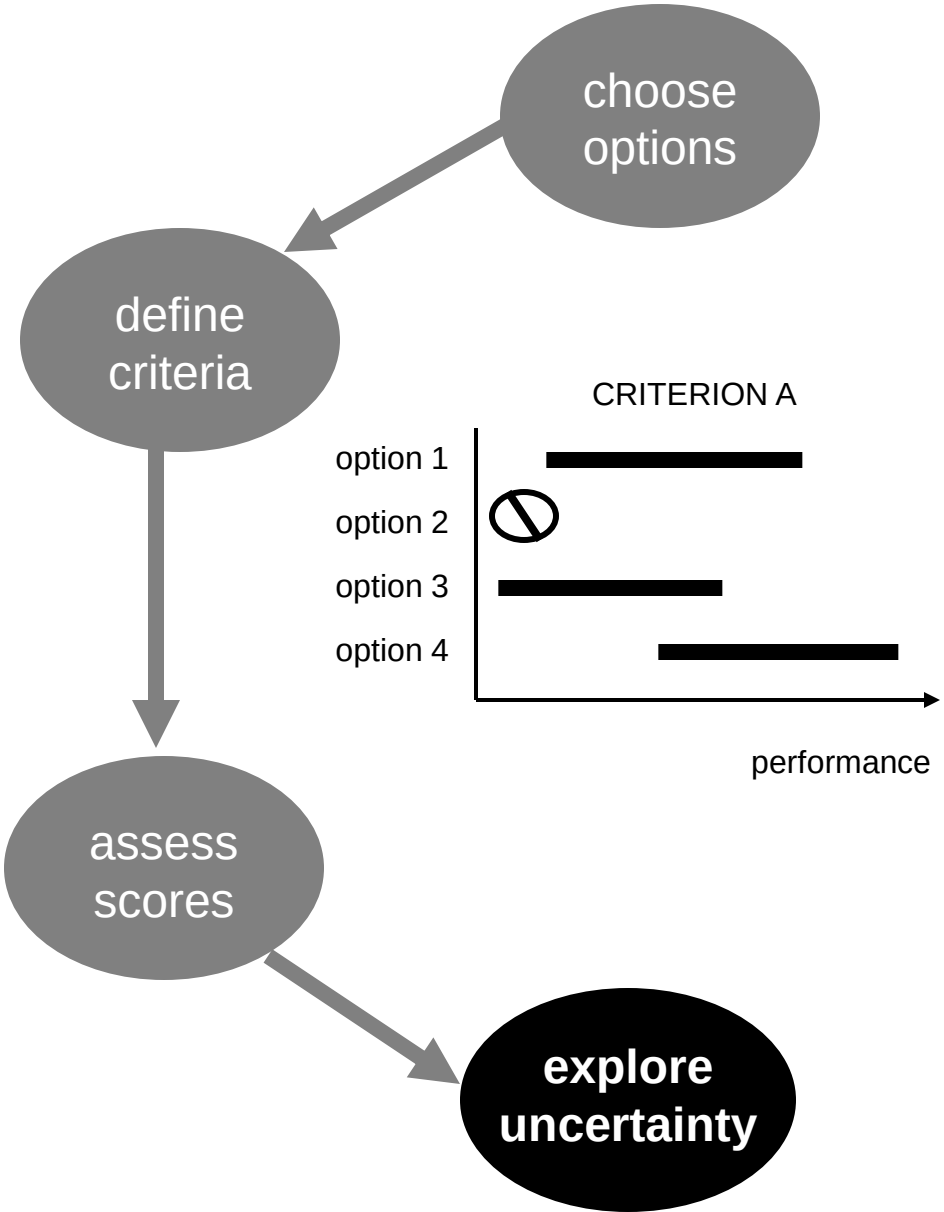

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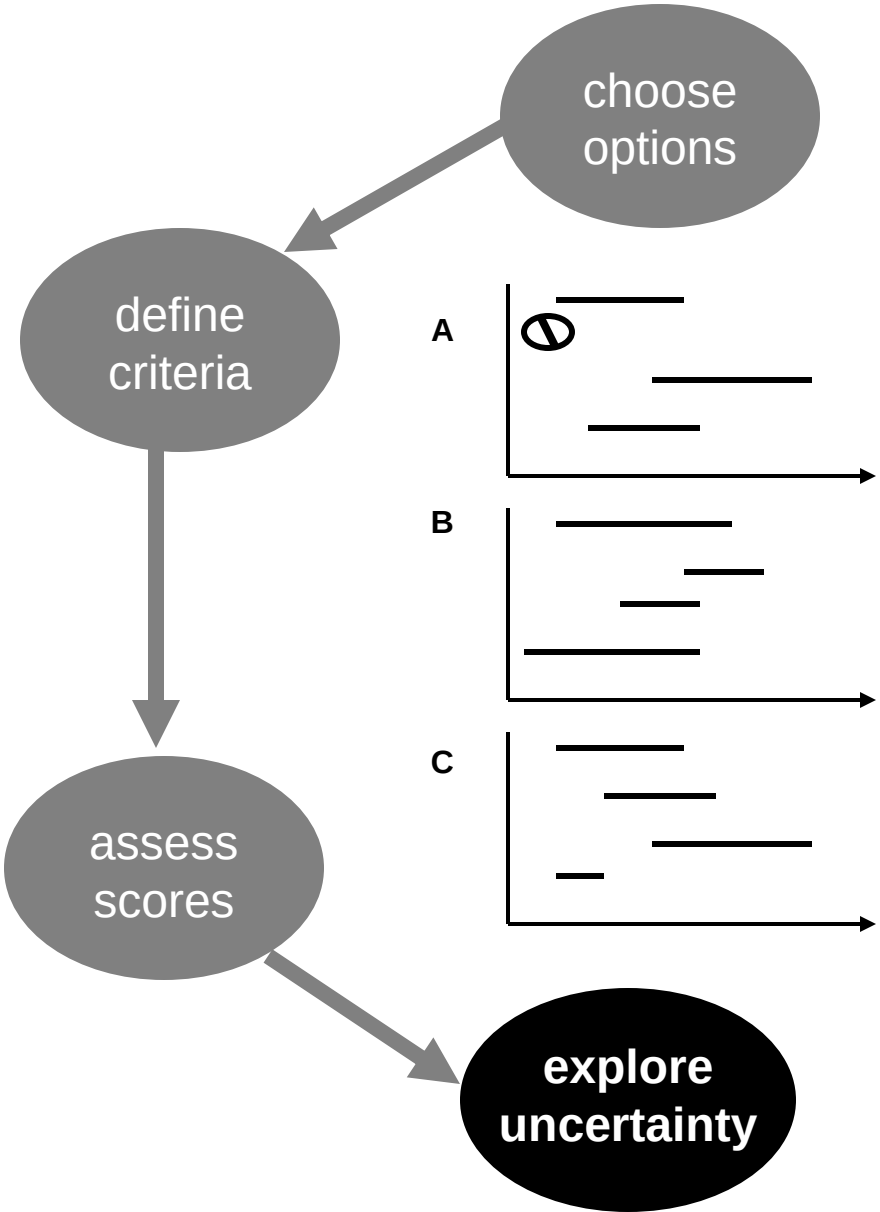

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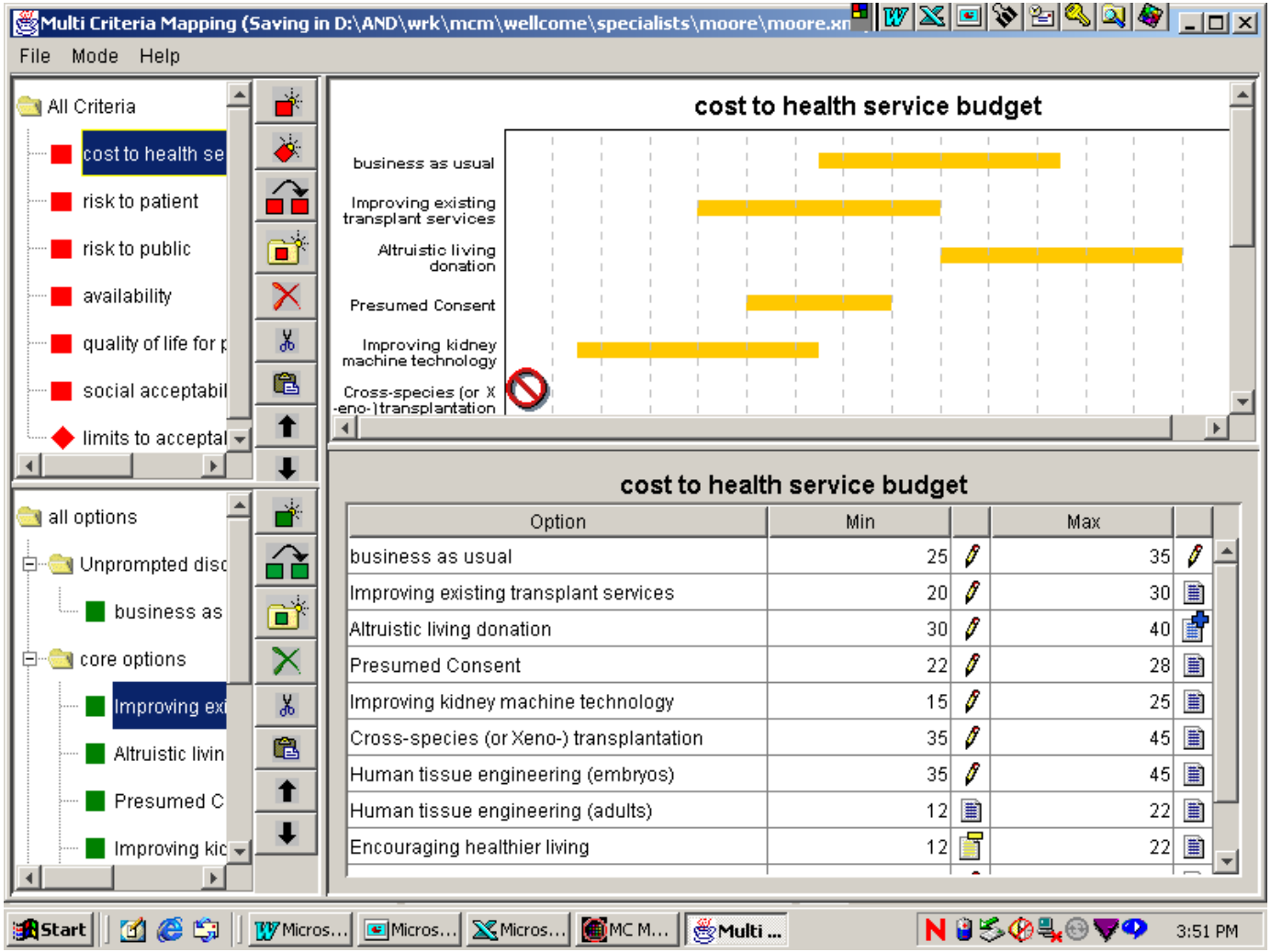

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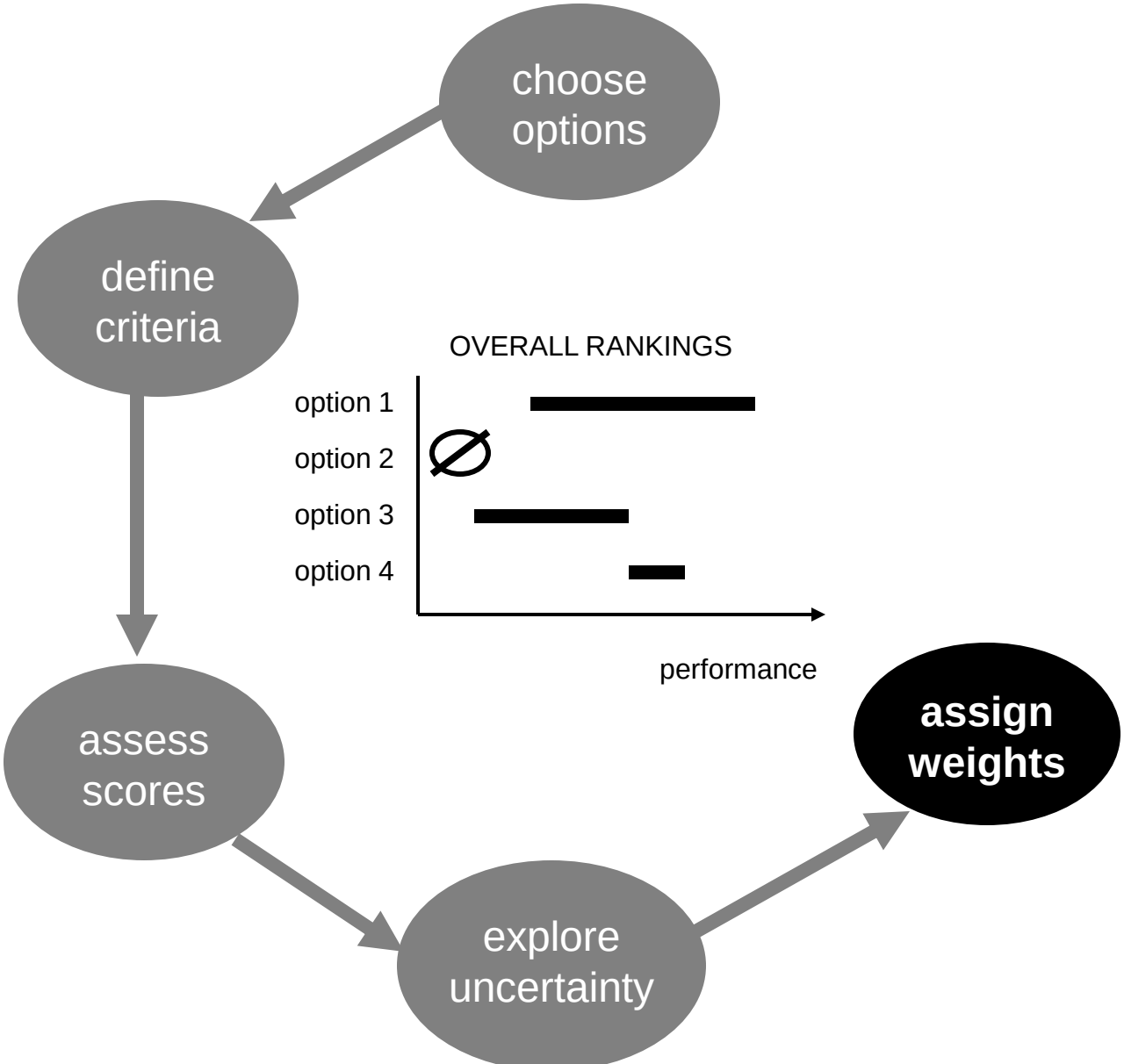

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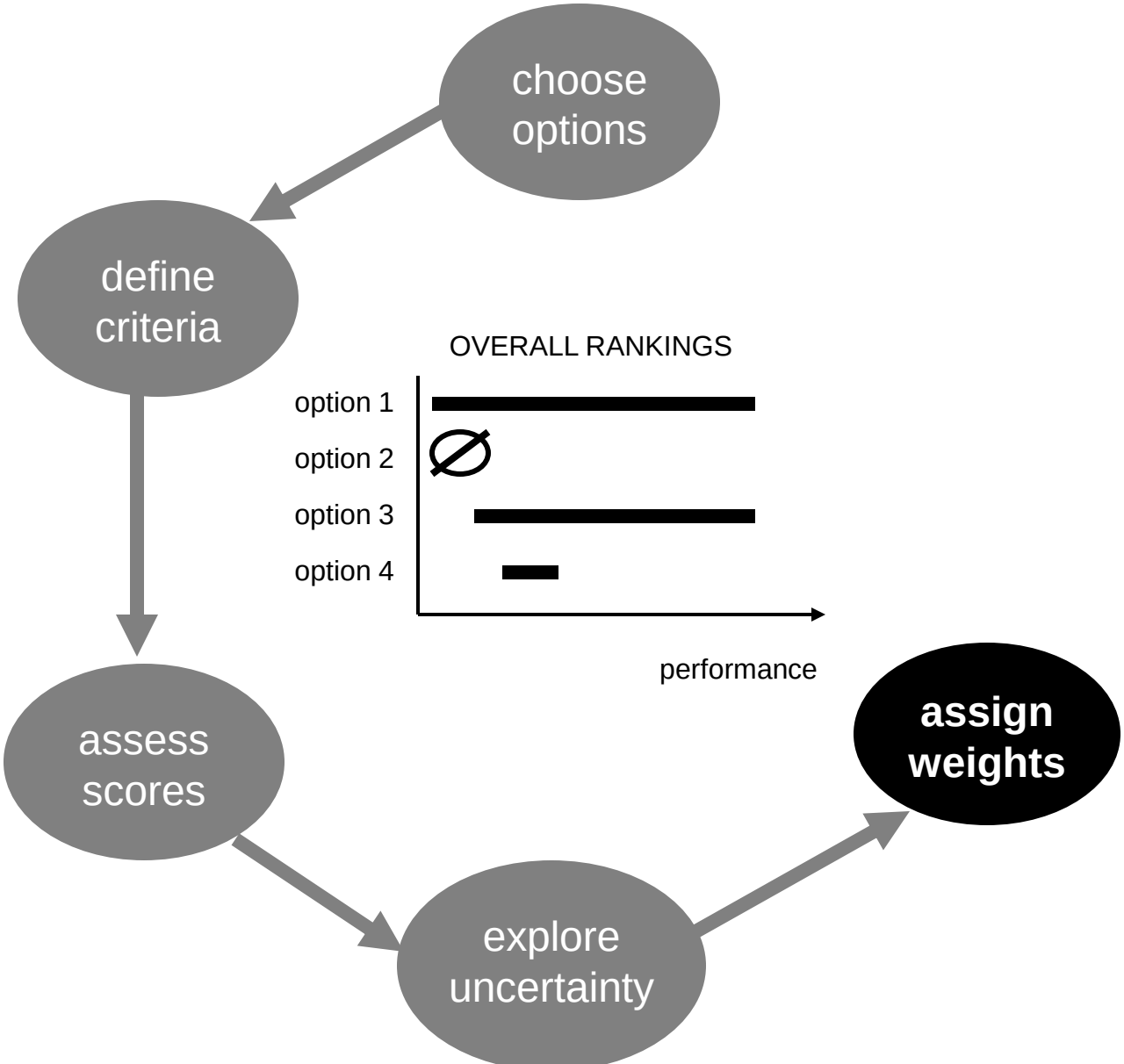

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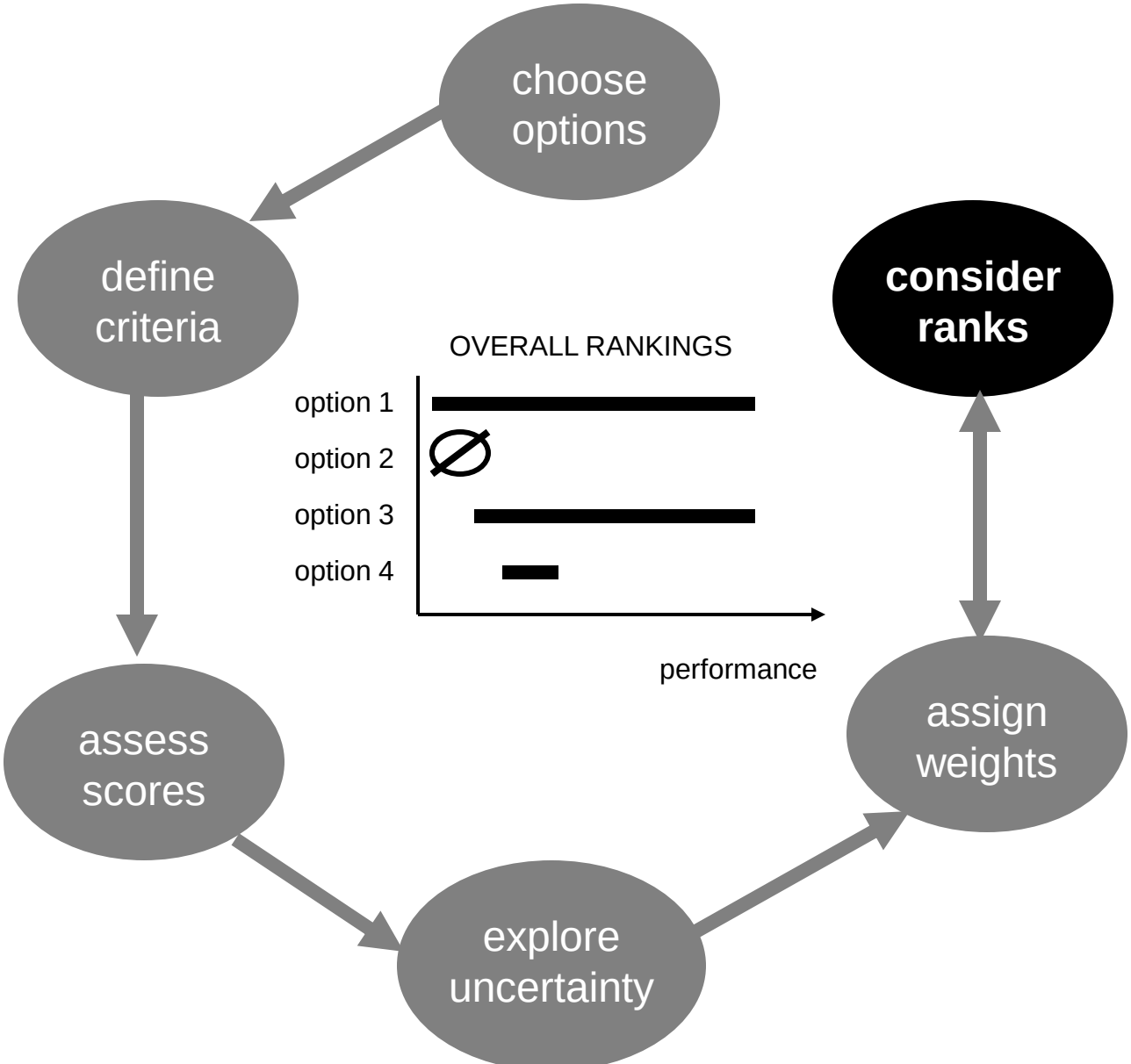

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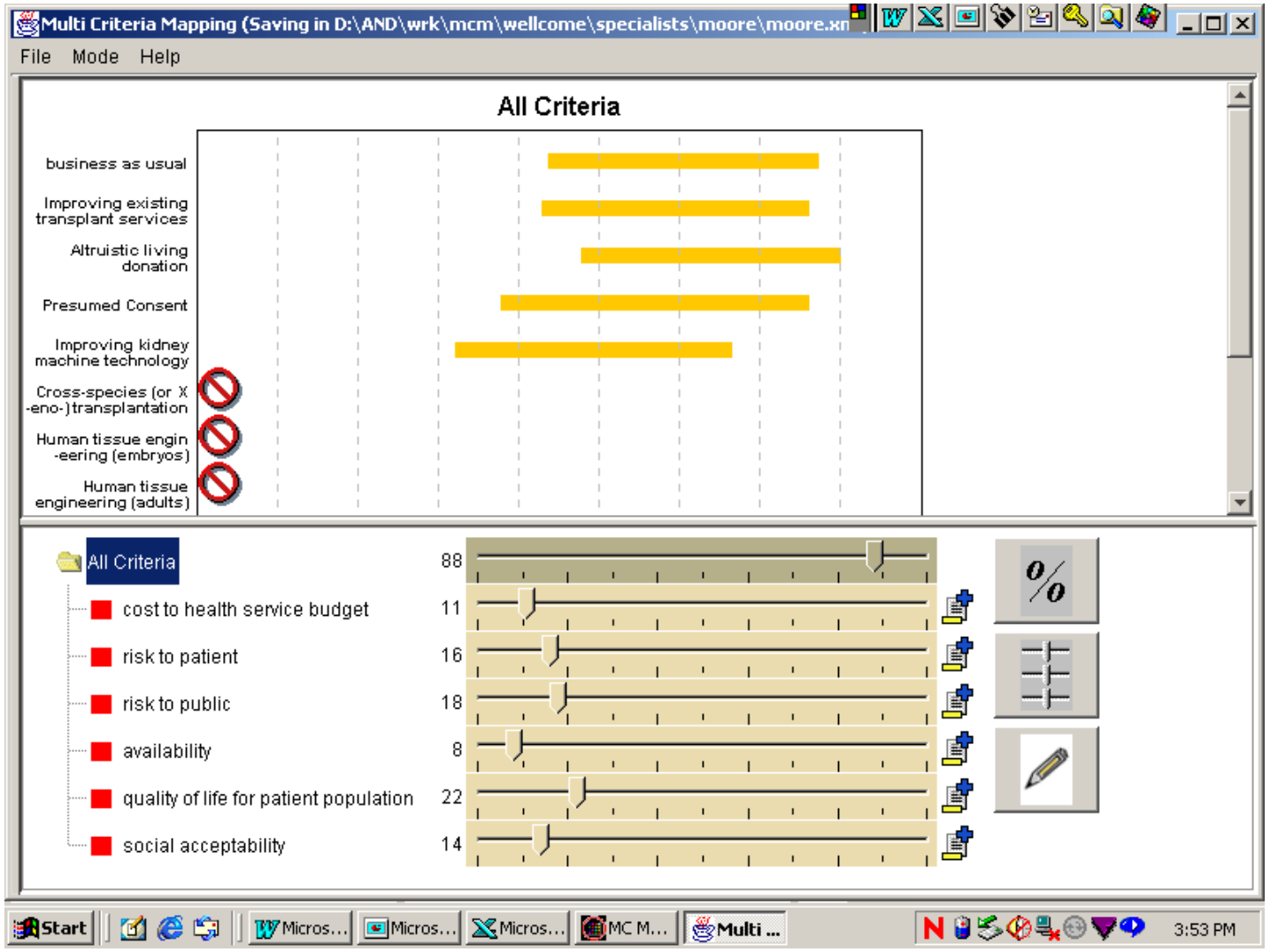

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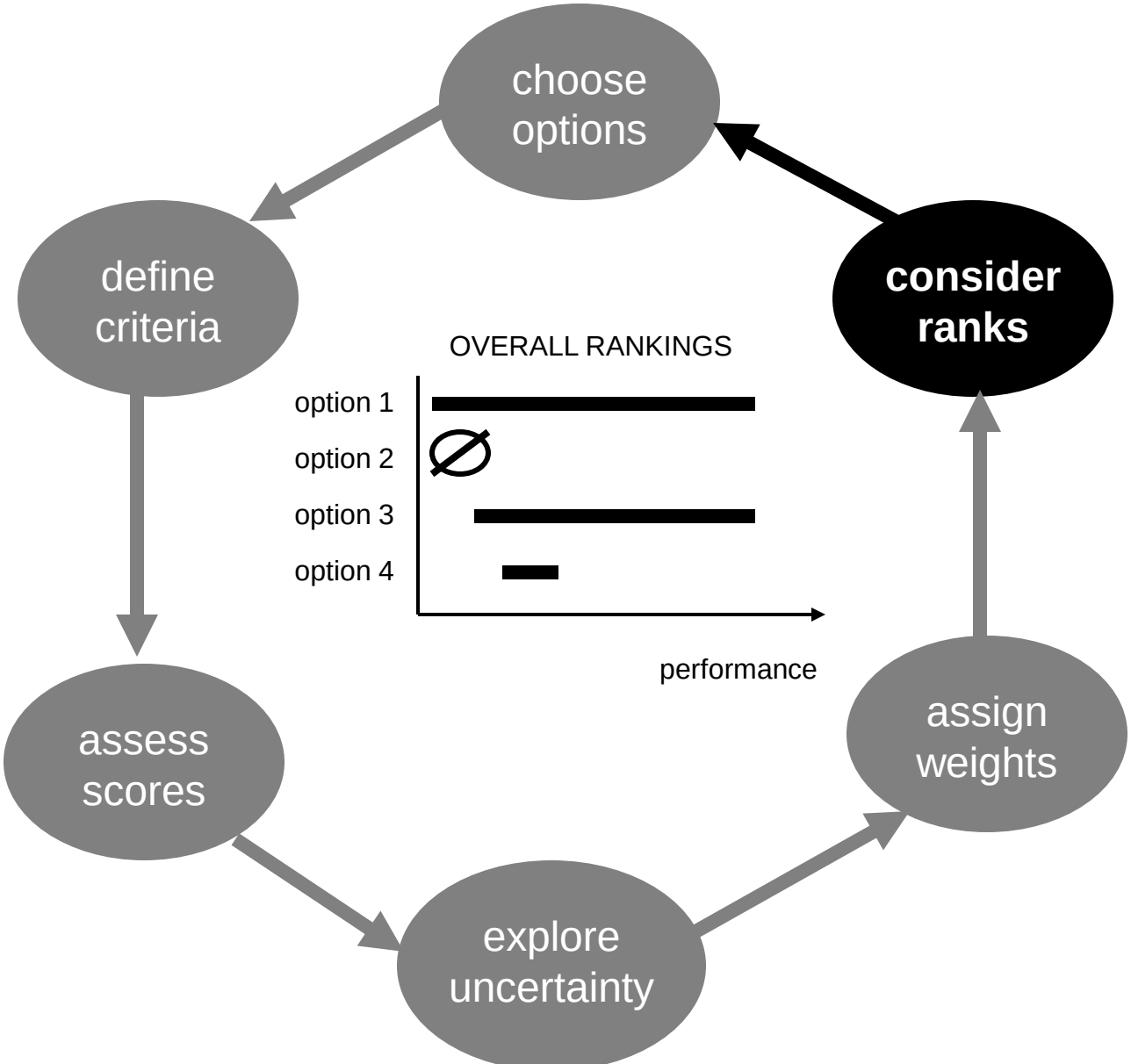

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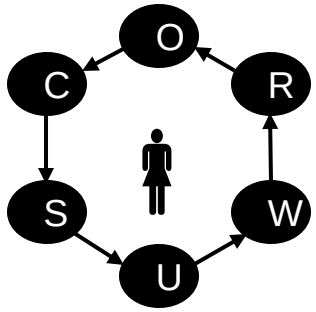

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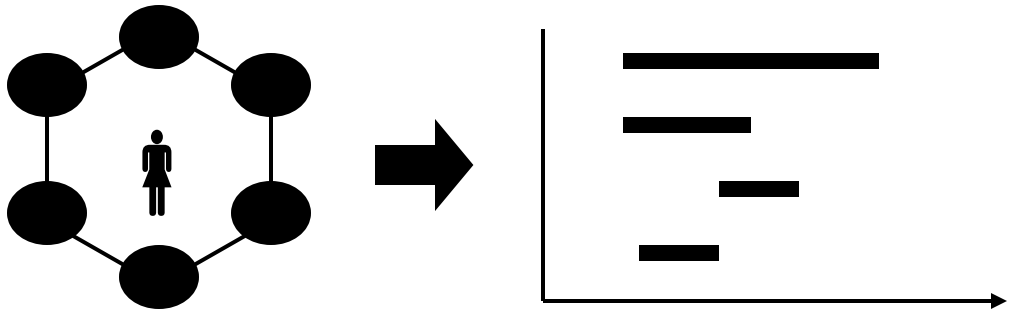

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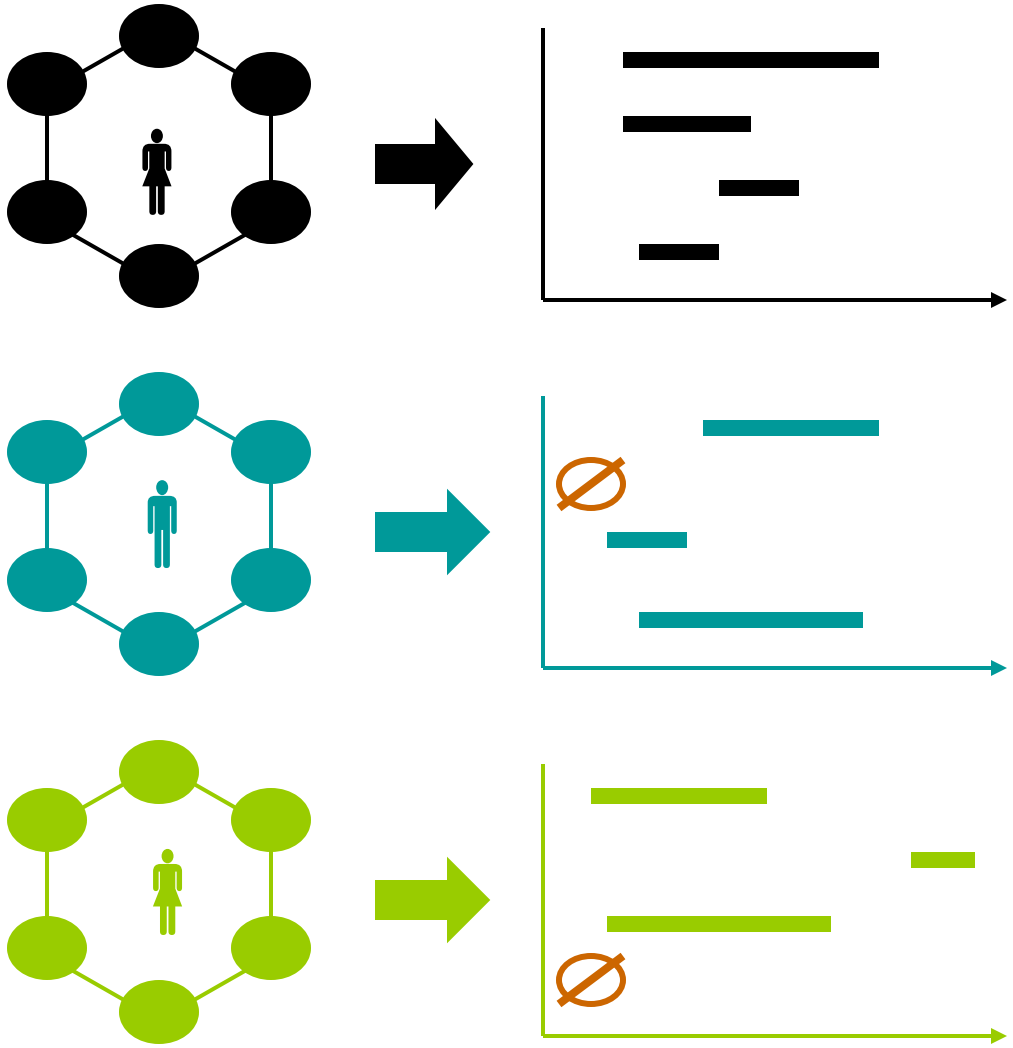

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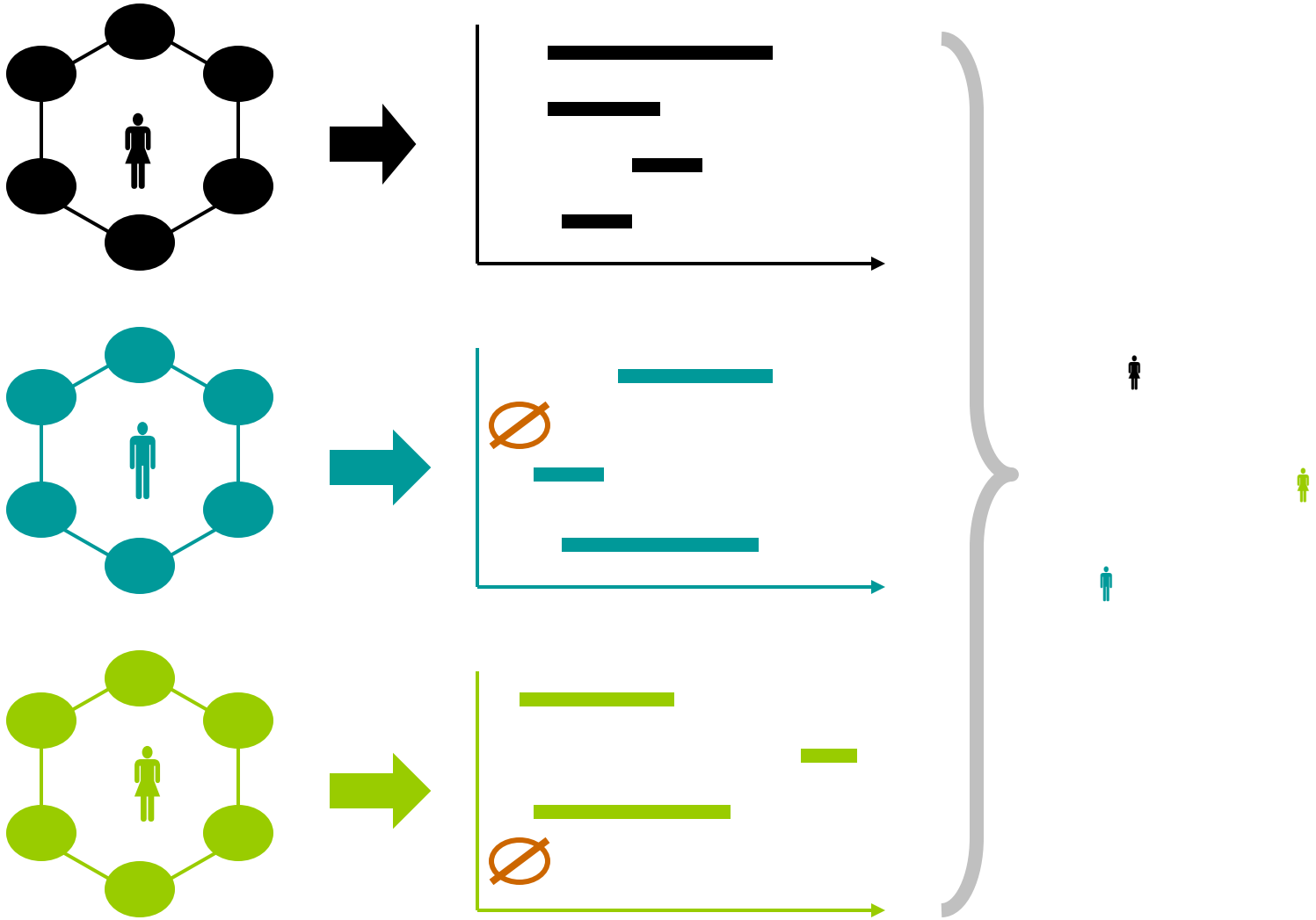

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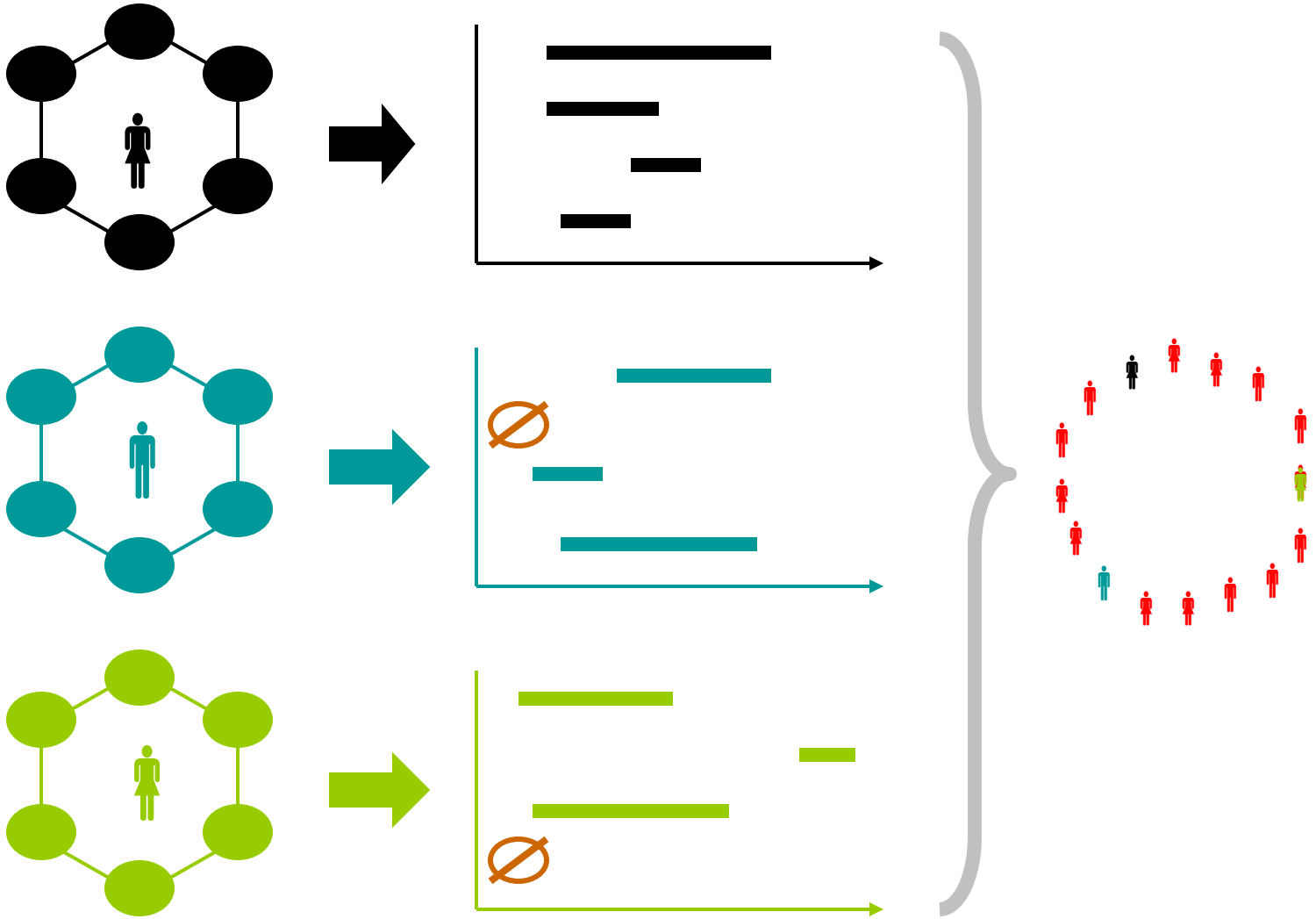
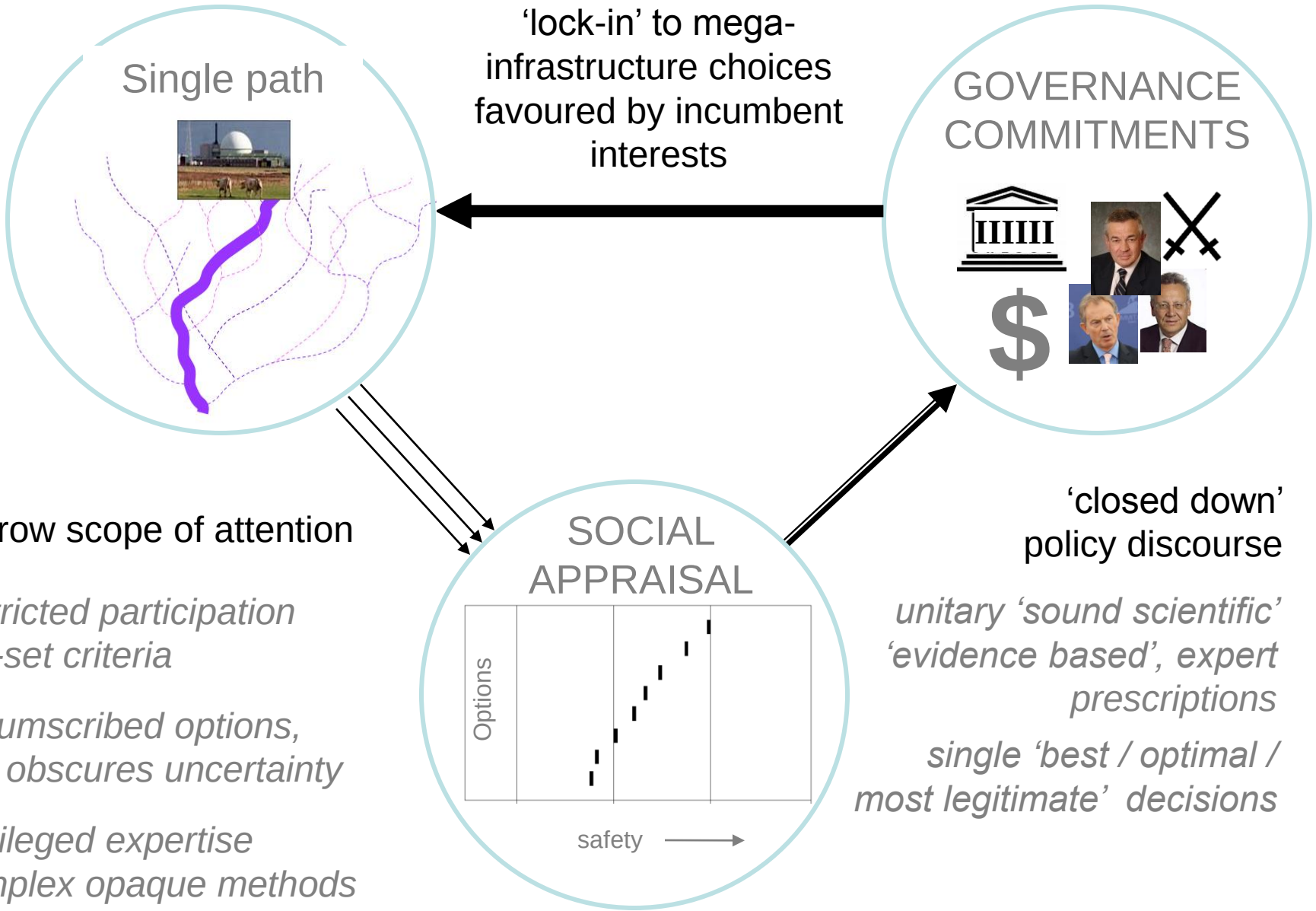
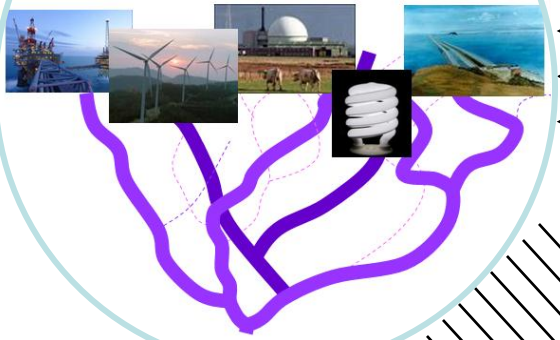


Broadening Out and Opening Up



‘Opening Up’ Innovation Governance

MULTIPLE PATHWAYS

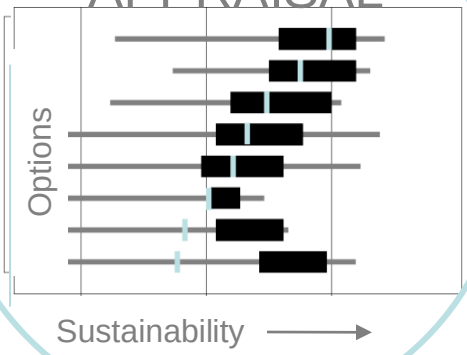


more diverse, flexible, politically deliberate ’learning portfolios’

GOVERNANCE COMMITMENTS

technical rigour
social reflexivity
democratic accountability

SOCIAL APPRAISAL



broad-based appraisal

extended participation
freely defined criteria

open options,
uncertainty addressed

diverse expertise
accessible simple methods

‘opening up’ infrastructure politics

‘best path’ depends on:
contexts, perspectives,
places, sensitivities,
scenarios, equilibria,
pathways, discourses

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www.multicriteria-mapping.org

Mega-Infrastructures are Inexorable

*"**you can't stop progress**" …*

- The Economist

*"we'll restore science to its **rightful place**"…*

- President Obama

*"Our **hope** … **relies on** scientific and technological **progress**"* - Premier Wen Jiabao

*"One **can not impede** scientific progress."*

- President Ahmadinejad

PROGRESS

time

SCIENCE

Mega-Infrastructure Progress is Linear

Lord Alec Broers, President, RAEng

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

Technology:

*"will **determine** the future of the human race""*

The challenge of government:

*"to **strive to stay** in the race"…*

The role of the public:

"*to give technology the **status it deserves**"…*

PROGRESS

direction

TECHNOLOGY

Mega-Infrastructure Progress is Linear

All innovation is progress…

Lisbon Strategy for: "***pro-innovation** action"*

- EU Council of Ministers

*"we need more **pro-innovation** policies"*

- PM Gordon Brown

"… the Government's strategy is …
***pro-innovation**"* - PM David Cameron

PROGRESS

direction

TECHNOLOGY

Mega-Infrastructure Progress is Linear

All technology is progress…

*"a **pro- technology** culture must be created…"*

- Council for Science and Technology

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

- UN Deputy Director General
  Lord Malloch-Brown

Which innovation?

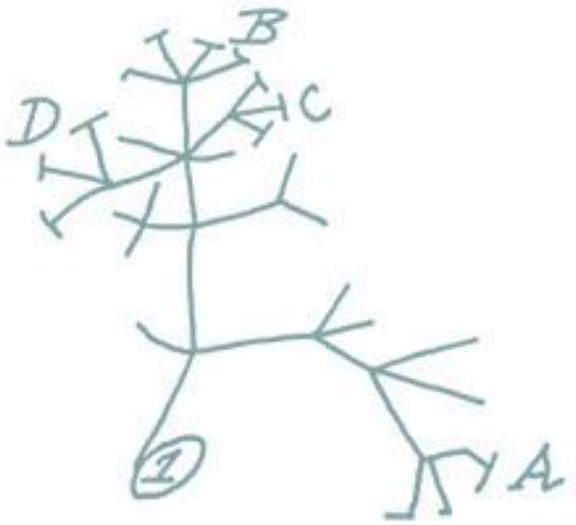
Being "pro-innovation" is like being "pro-policy"

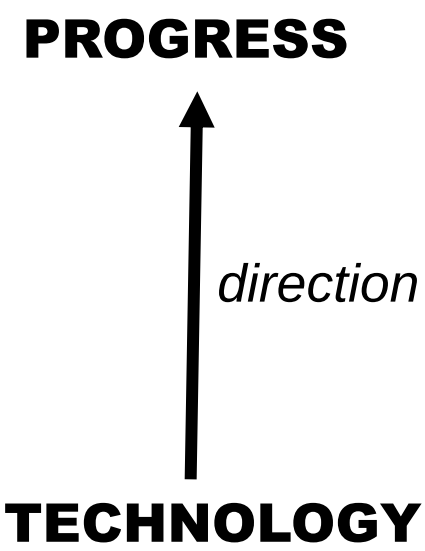
PROGRESS

direction

TECHNOLOGY

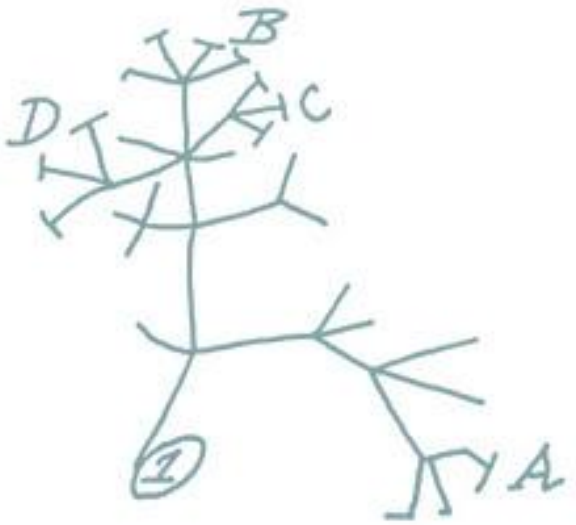
Mega-Infrastructure Progress is Linear

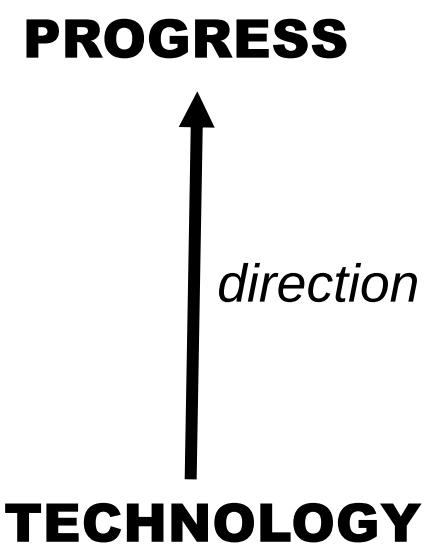




Treats innovation as homogeneous: ***no distinctions … no alternatives…***
no politics … no choice !

Mega-Infrastructure Progress is Linear

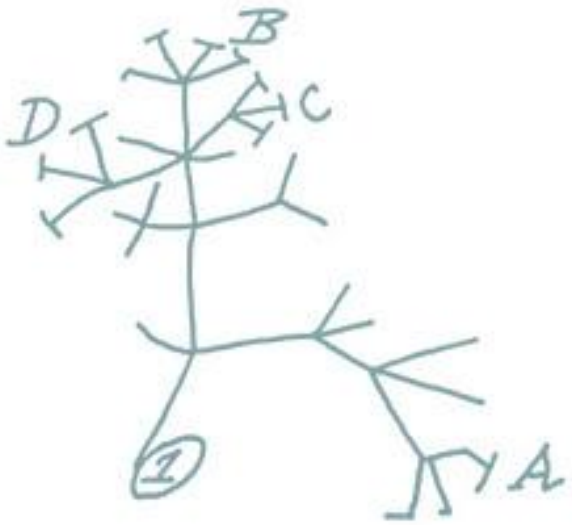


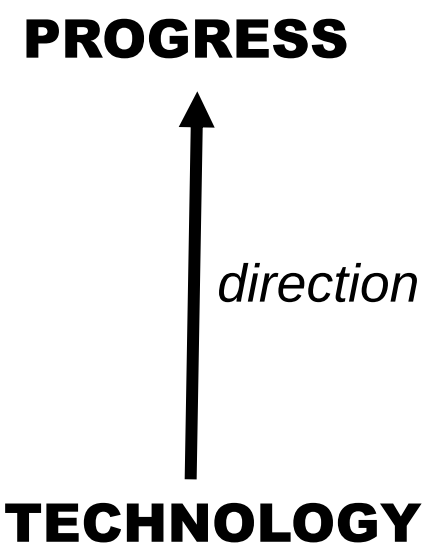


Treats innovation as homogeneous: *no distinctions … no alternatives … no politics … no choice !*

Scope for debate restricted to: ***yes or no? … how much? how fast? … who leads?***

Mega-Infrastructure Progress is Linear





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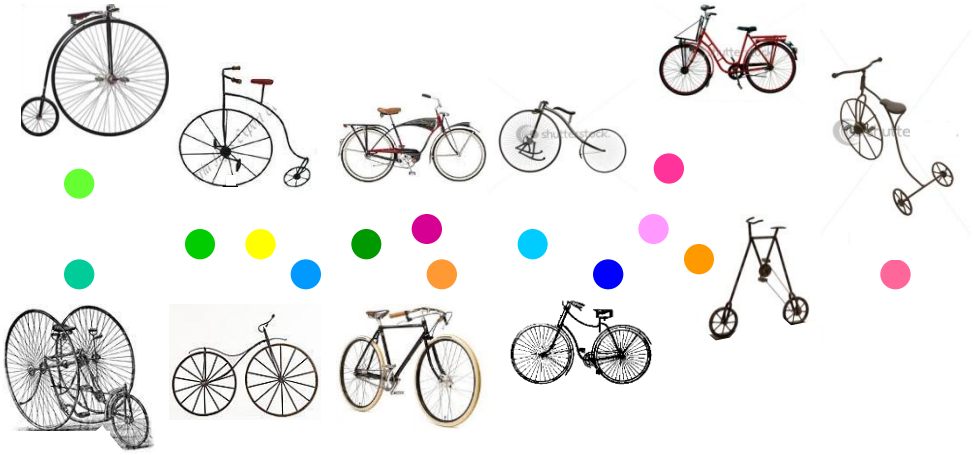
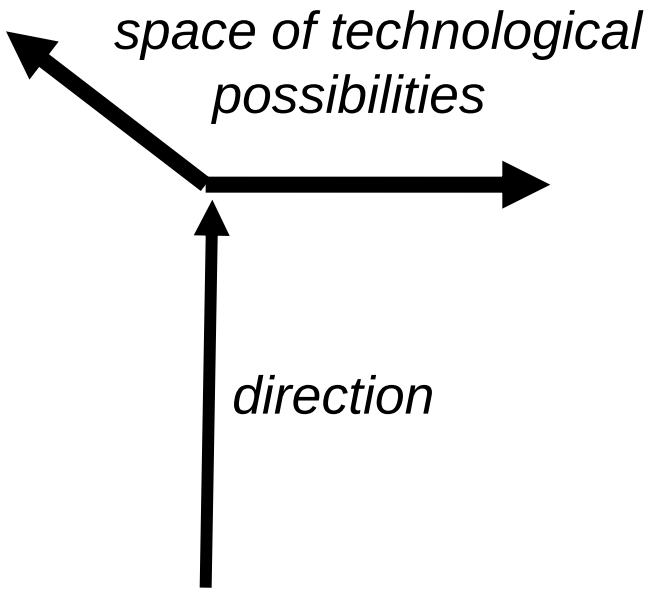
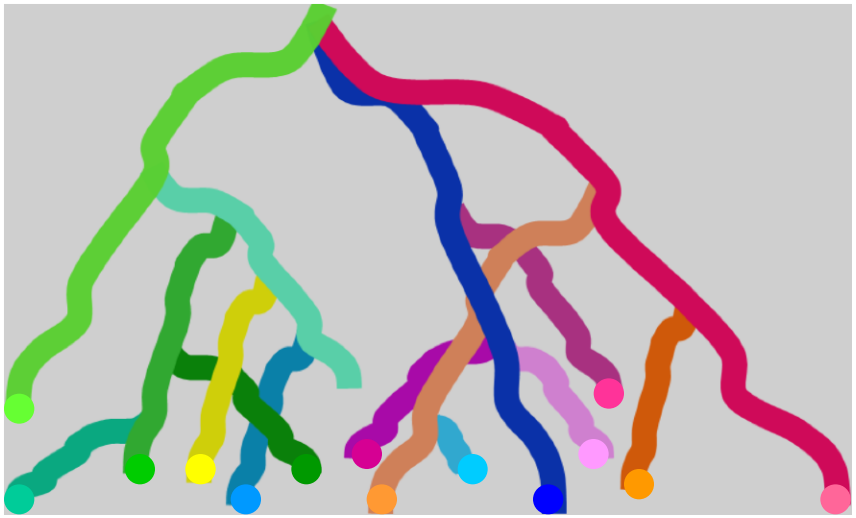
	no politics	*… no choice !*
Scope for debate restricted to:	*yes or no?*	*… how much?*
	how fast?'	*… who leads?*
Seriously neglects questions over:	***which way?***	***…what alternatives?***
	says who?	***…why?***

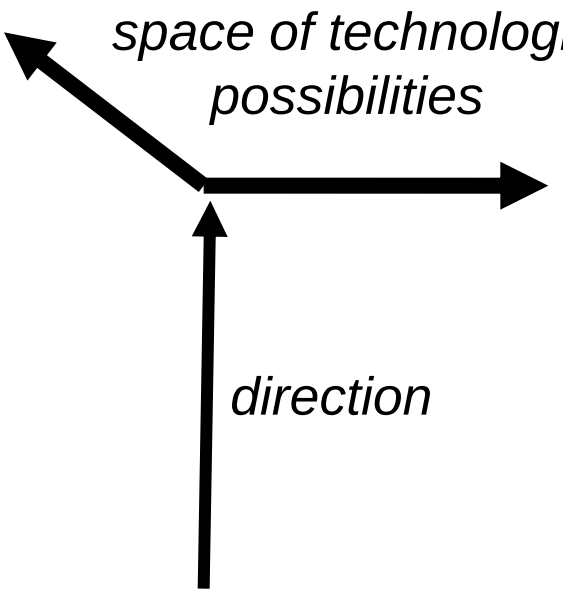
The Economics of Progress





The Economics of Progress





Mainstream economics take underlying direction as given:

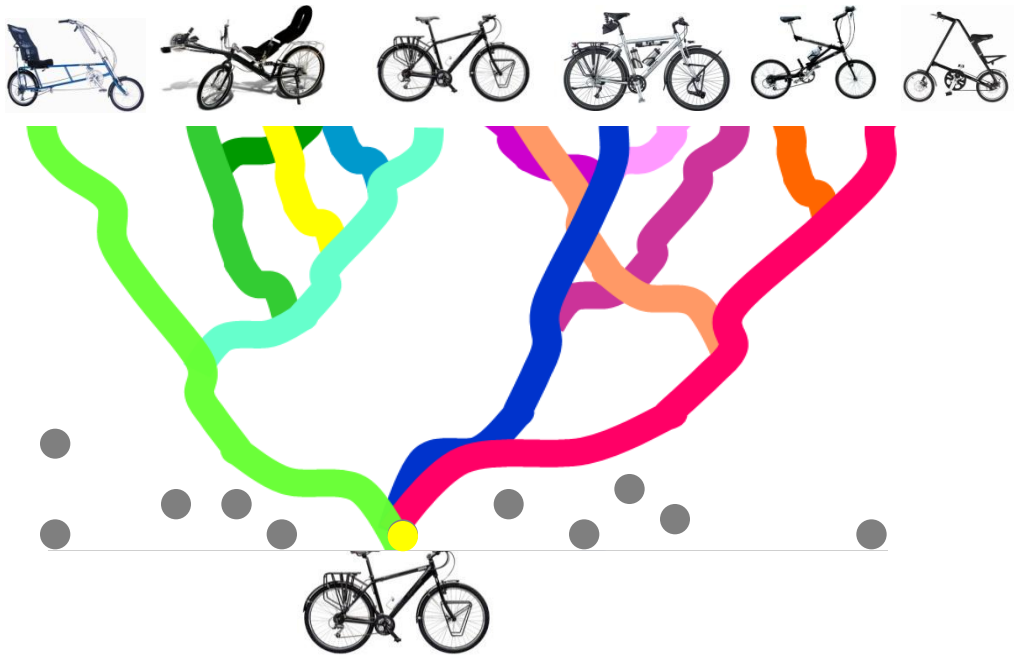
in each functional ‘niche’, diverse ‘experiments’ converge to optimality

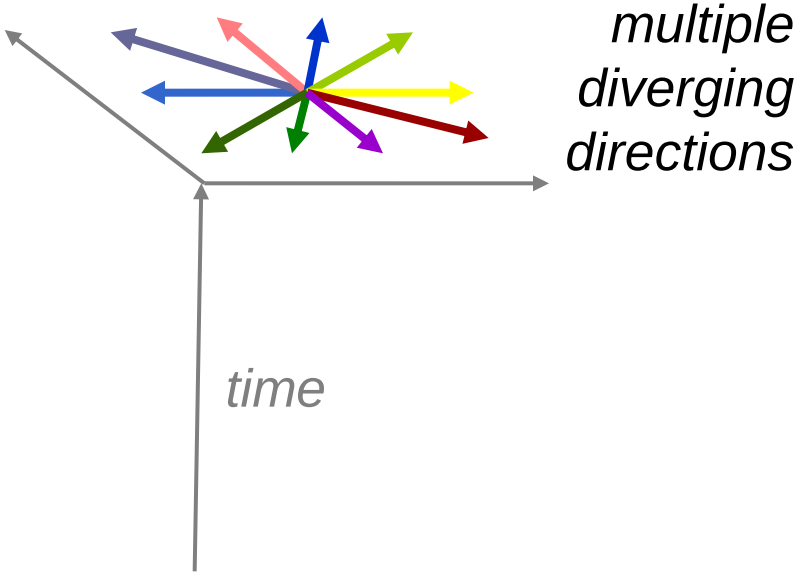
Broad process of self-evident improvement is thought to underlie growth

- Schumpeter, Abramowtiz, Arrow, Solow, Dixit, Stiglitz, Nordhaus, Griliches, Romer

But – as in biology – ‘optimality’ depends on context and perspective

Closing Down the Direction of Progress





Common picture arising in all studies of technology in society –

… *the 'big picture' is more the other way around!*

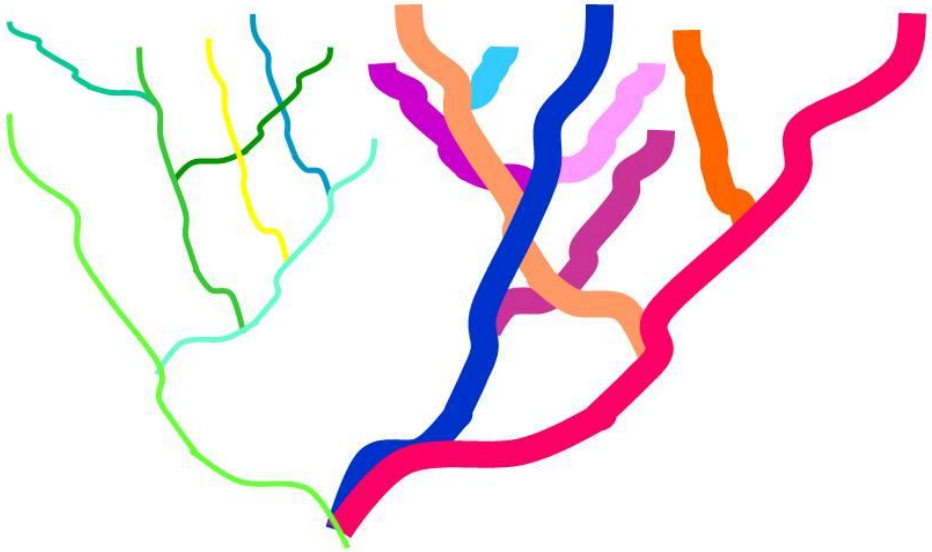
each starting point yields many feasible, viable innovation pathways

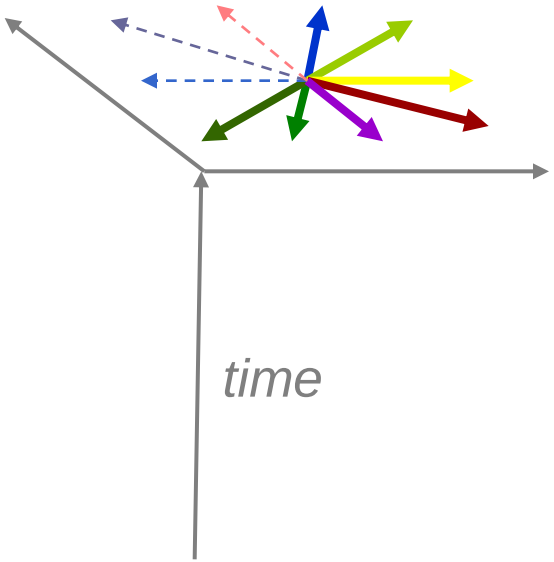
'best path' not just about determining necessity or 'optimising' markets …

deliberately or blindly ***societies lock-in to their technological pathways***

- Ellul, Freeman, Perez, Nelson, Bijker, Mokyr, Karnoe, Geels

Closing Down the Direction of Progress



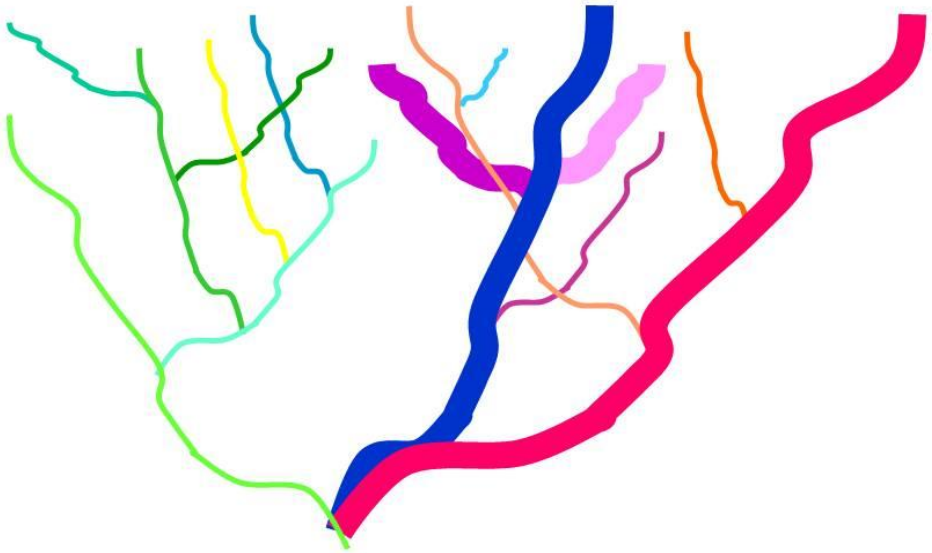


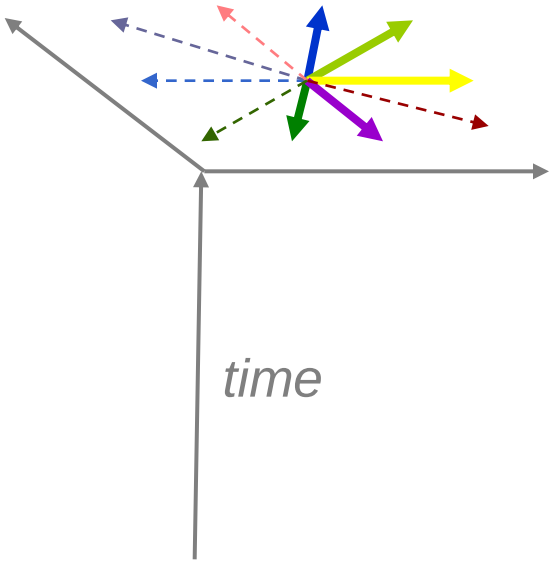
innovation is 'vector' not 'scalar'

social imaginations and expectations

- Jasanoff, van Lente

Closing Down the Direction of Progress





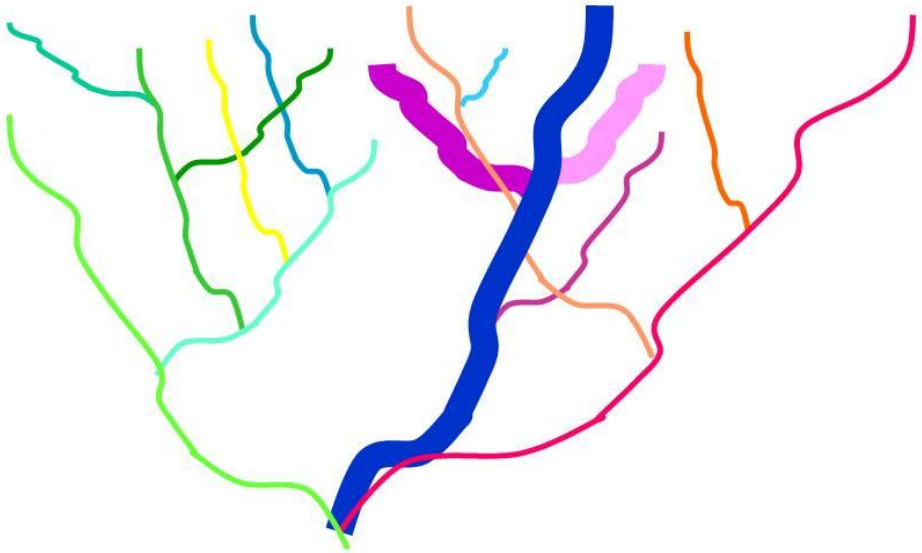
innovation is 'vector' not 'scalar'

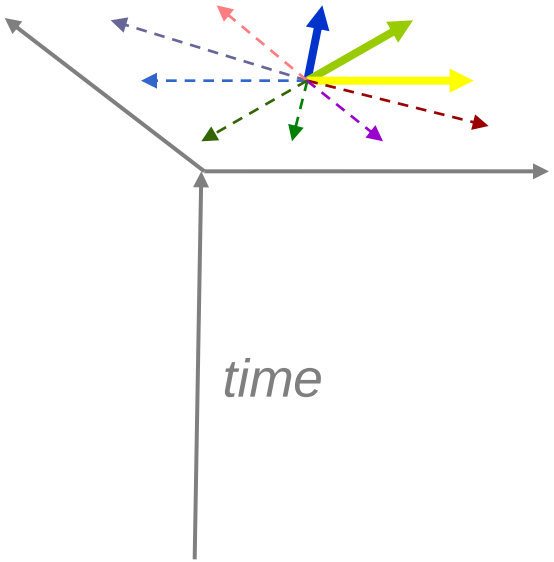
social imaginations and expectations

political 'autonomy' and 'entrapment'

- Winner, Walker

Closing Down the Direction of Progress





innovation is 'vector' not 'scalar'

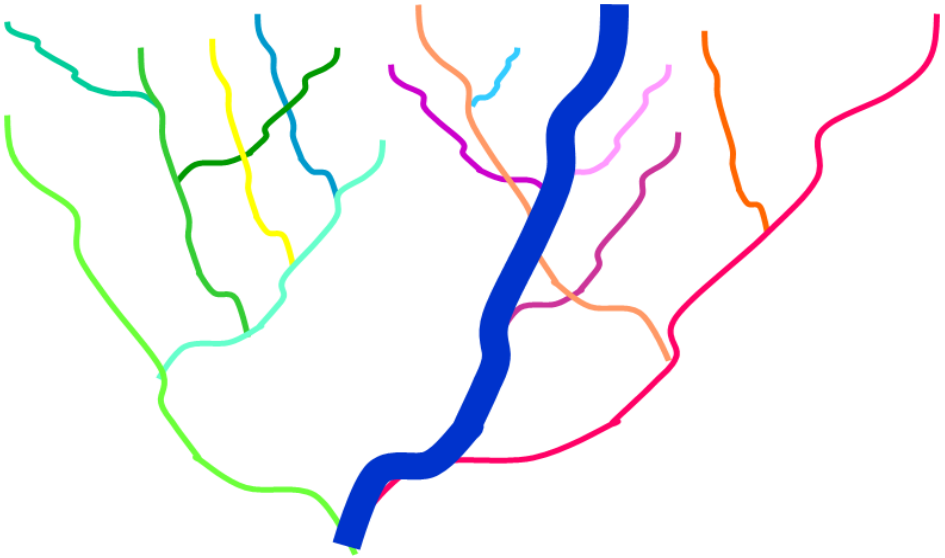
social imaginations and expectations

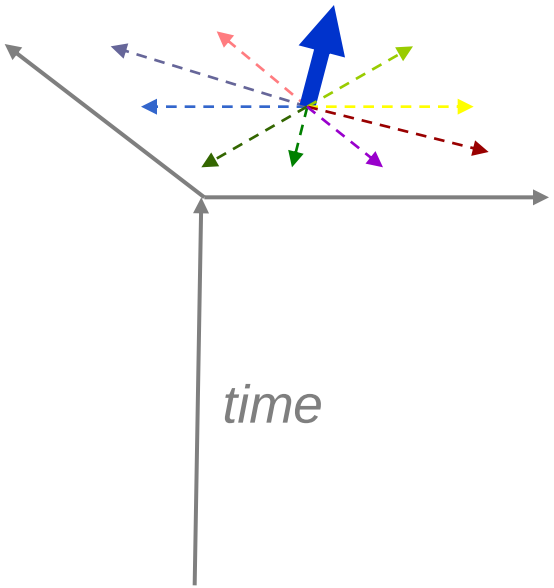
political 'autonomy' and 'entrapment'

historical 'momentum' and 'path dependency'

- Hughes, David

Closing Down the Direction of Progress





innovation is 'vector' not 'scalar'

social imaginations and expectations

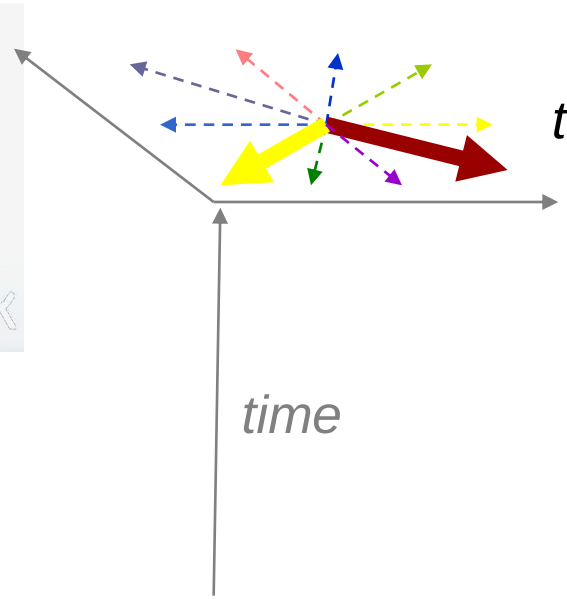
political 'autonomy' and 'entrapment'

historical 'momentum' and 'path dependency'

economic 'trajectories' and 'lock-in'

- Dosi, Arthur

Alternative Futures



Much technology politics is not about 'risk'… but which path to take?

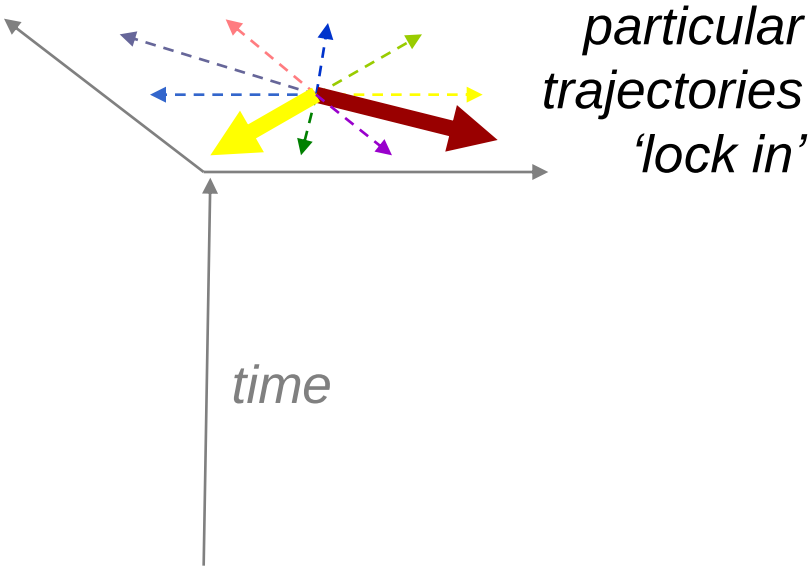
eg: advanced bioscience in agriculture

– transgenics or syngenics

– engineering or marker assist?

– IP-intense breeding or farmer selection?

Alternative Futures



Much technology politics is not about 'risk'… but which path to take?

eg: pharmaceuticals, neuroscience, nanotechnology, robotics…

– northern or southern markets? ("10 / 90 gap")

– public health or private enhancement?

– military or civilian applications?