IRAS

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rivm

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for Public Health
and the Environment

What science for which questions?

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Picture from WRR report Uncertain Safety

The the clear and simple answer:

- Good science!

- On the other hand.....
- Every complex problems has a simple answer, but it’s always wrong (Mencken)

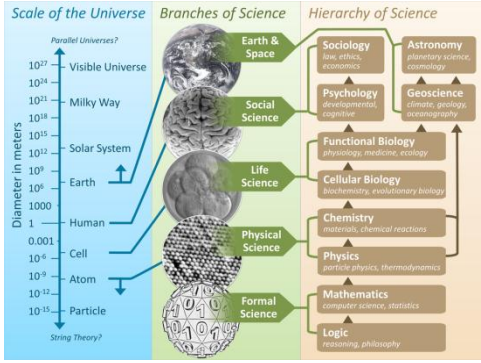
- Senator Edmund Muskie: “Will somebody find me a one-handed scientist?!”

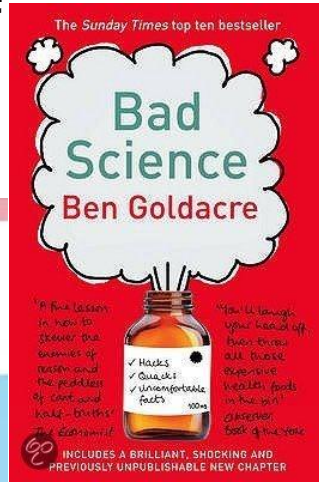
Science according to Wikipedia

- **Science** (from Latin *scientia*, meaning "knowledge"[1]) is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe.[2][3] In an older and closely related meaning, "science" also refers to a body of knowledge itself, of the type that can be rationally explained and reliably applied. A practitioner of science is known as a scientist.

Different sciences

- Based on topic and scale
- Based on degree of cooperation:
  mono, multi, interdisciplinary
- Based on time period and relation to society:
  free, applied, translational, transdisciplinary, citizen science
- Based on appreciation and intended (mis)use:
  Pseudoscience, junk science, bad science
- ‘Science in Transition’





Which questions? Rather technical?

- What can perturbations of toxicity pathways tell us about (health) risks?
- How can Adverse Outcome Pathways improve risk assessment?
- How can we digest, review, summarise and appreciate the enormous production of scientific publications for risk assessment purposes?
- What is the 'Value of Information' of yet another risk assessment study to risk management decisions?
- What levels of endocrine disruptors are safe?
- Reference doses: does adding human data help?

Health as the ability to adapt and to self manage, in the face of social, physical and emotional challenges

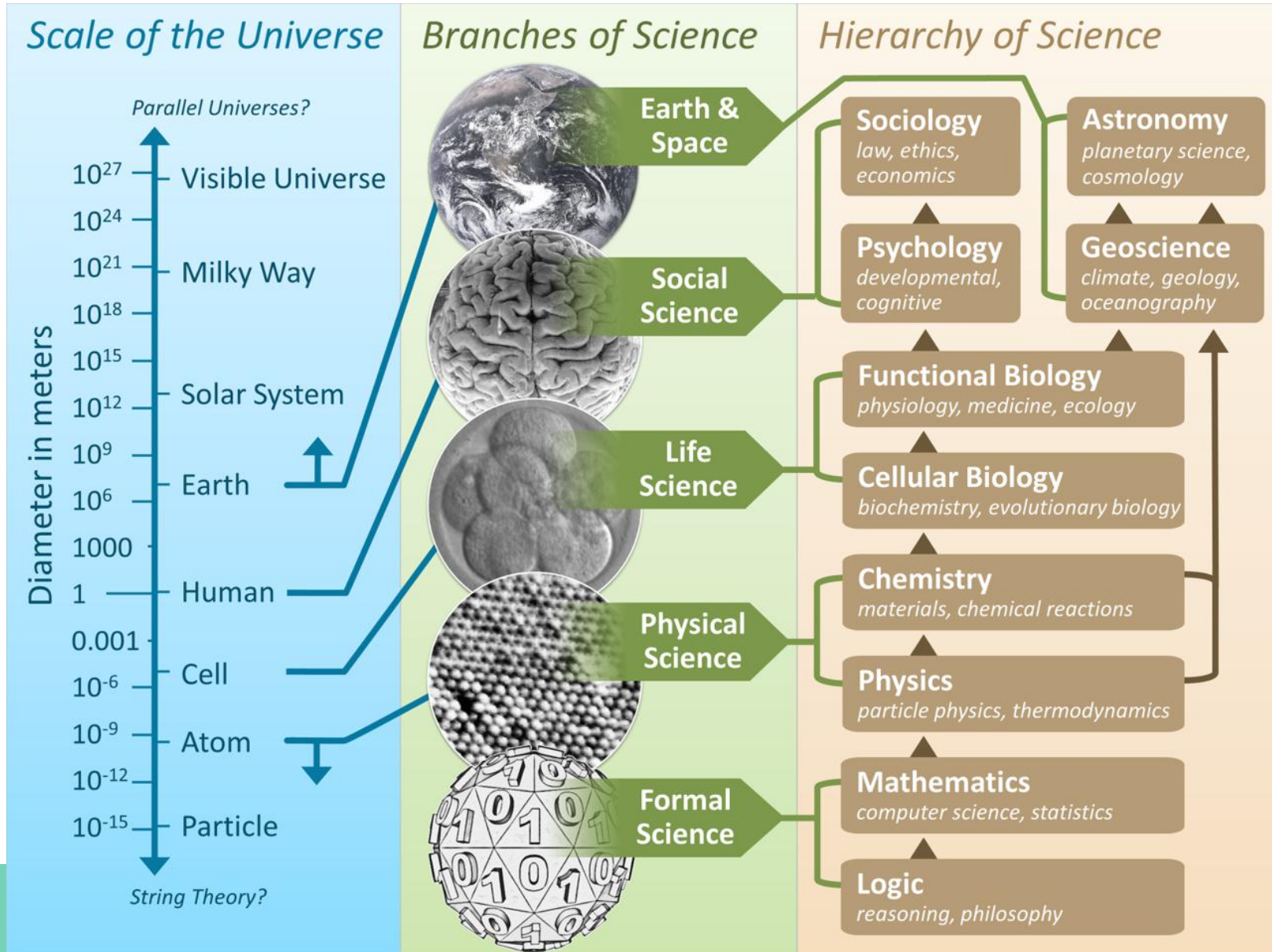
Which questions? More contextual?

- How should we define health? WHO or Huber et al. BMJ 2011?
- What is the probability that a research finding is true? Or 'Why Most Published Research Findings Are False' (Ioannidis JPA (2005) PLoS Med 2(8): e124.
- How can we debunk crappy (epi-)studies on effects of endocrine disruptors?
- How can we increase the acceptance of publications funded by industry? A few bad apples…..?
- Why is BPA regulated?

The Question and Challenge

- How can we optimally accommodate (innovative) development, production and use of chemical substances in society, balancing and limiting (potential) risks against (potential) societal benefits, without stifling innovation, delaying adequate risk assessment and safe-by-design approaches, high waste production, high costs and administrative/regulatory burden?

Science? What science!



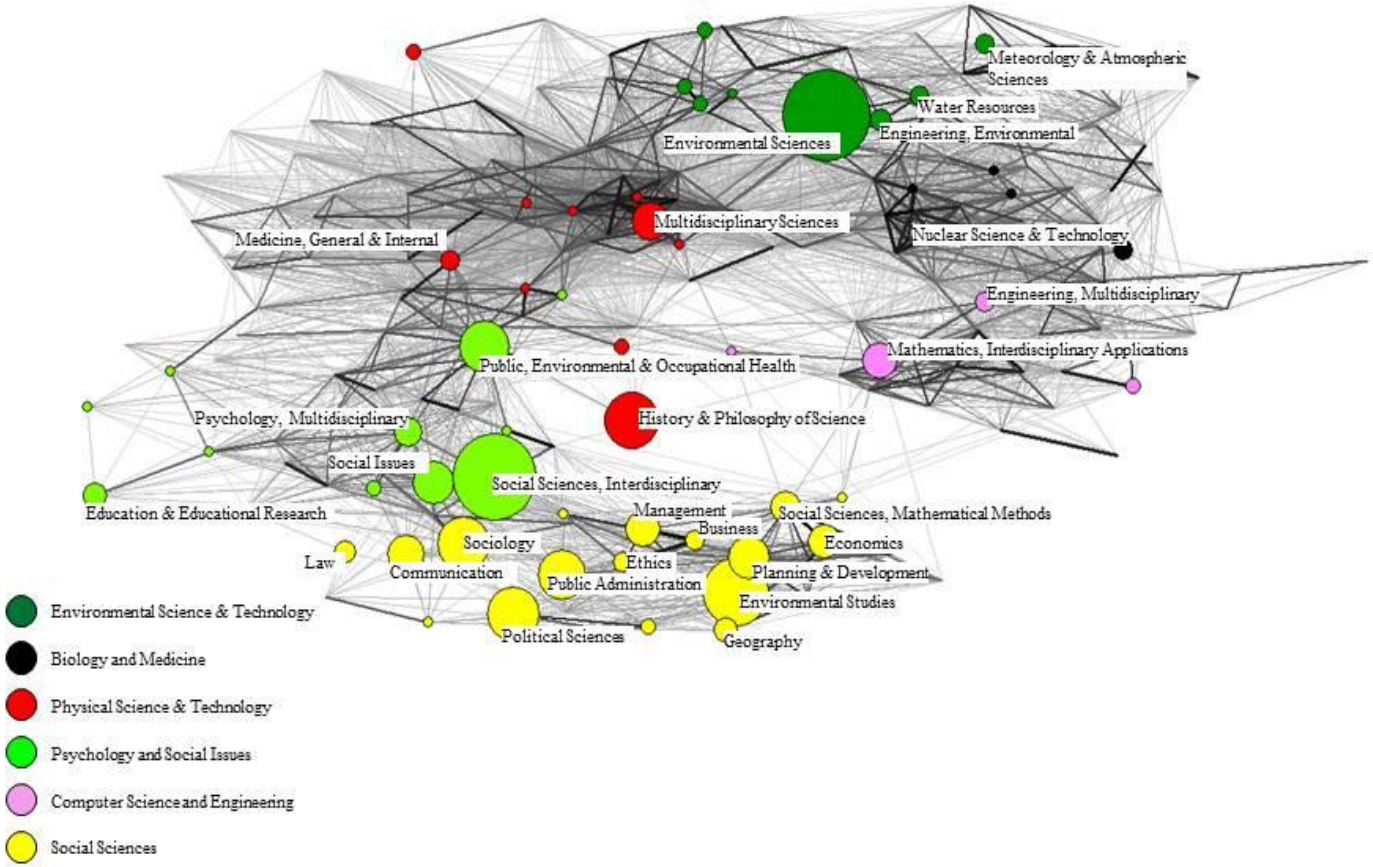
Science 1.0 – 3.0

Autonomy in science

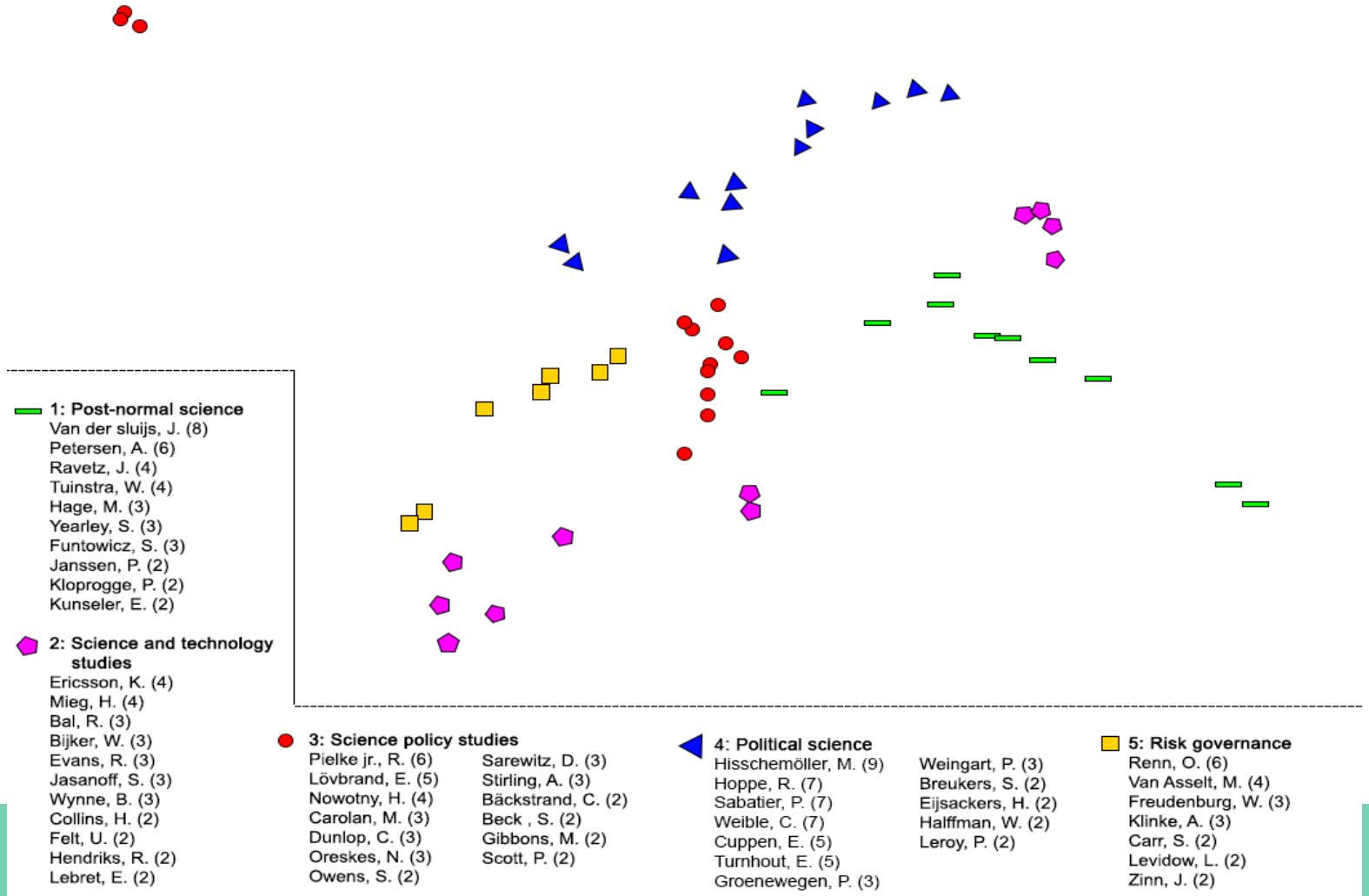
Influence of society

1.0	2.0	3.0
Independent autonomous science:	Institutionalised science:	Transdisciplinary science:
Science separated from society	Lineair cause-effect relations	Questions and answers in interaction with society
Enlightenment	Modernism (Mode-1)	Post-normal (Mode-2)

Cluster analysis by discipline; literature on the role of experts in policy advice. (Spruijt et al submitted)



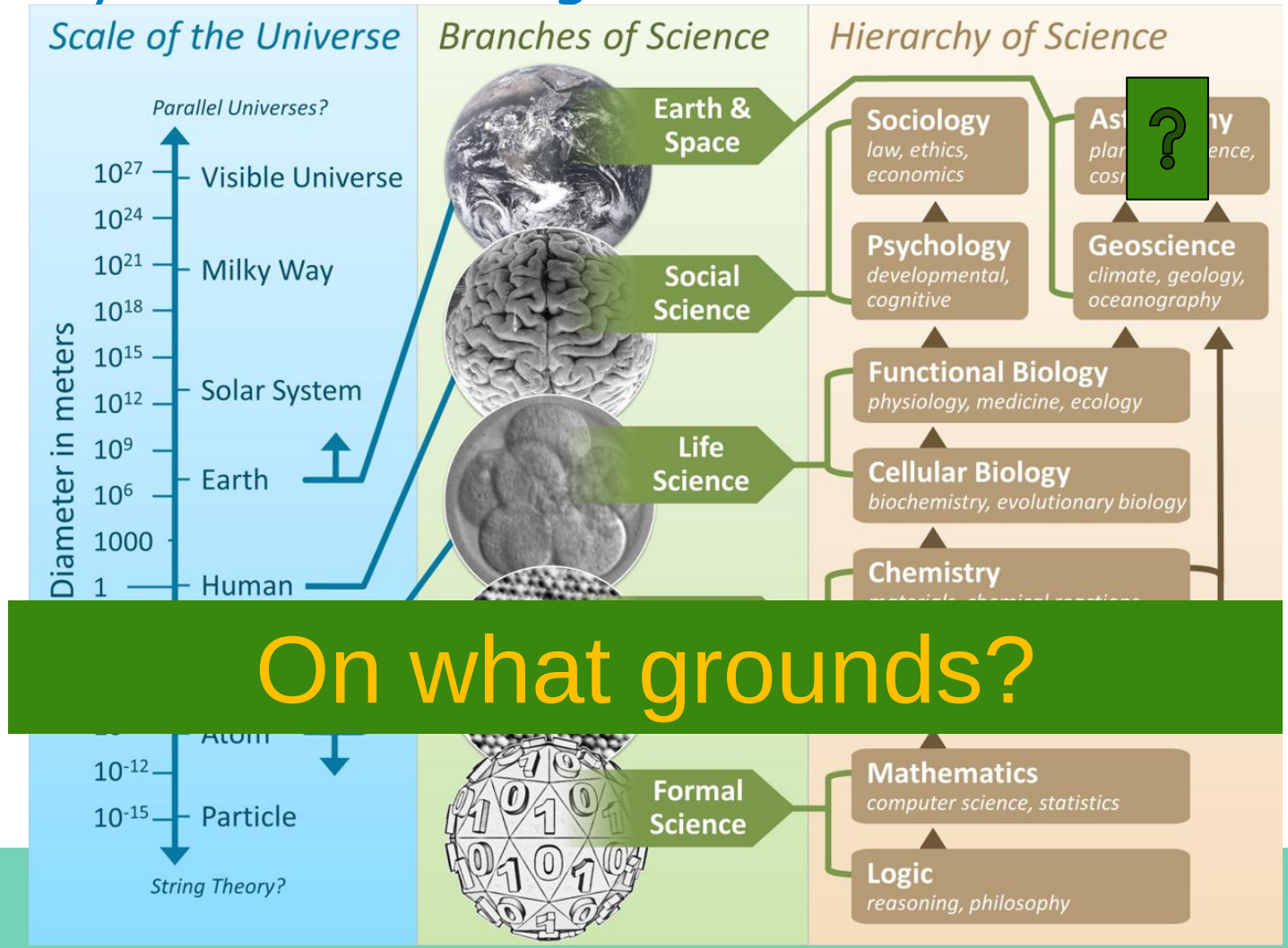
Co-citation analysis of literature on the role of experts in policy advice. (Spruijt et al submitted)



Common elements for expert roles

Suggestions to improve ways in which experts (should) advise on complex issues	Cluster number				
	Post-normal science	Science & technology studies	Science Policy studies	Political Science	Risk Governance
Transparency in methods, assumptions, etc.	X	X	X		
Professional attitude of humility		X	X		
Public participation, democratizing science (i.e. stakeholder dialogues)	X	X	X	X	X
Precautionary principle					X
Explicating different points of view within the expert community		X	X		

Claim 1: you need virtually all these sciences for a socially robust dealing with risks of chemicals



On what grounds?

National Institute for Public Health
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Ministry of Health, Welfare and Sport

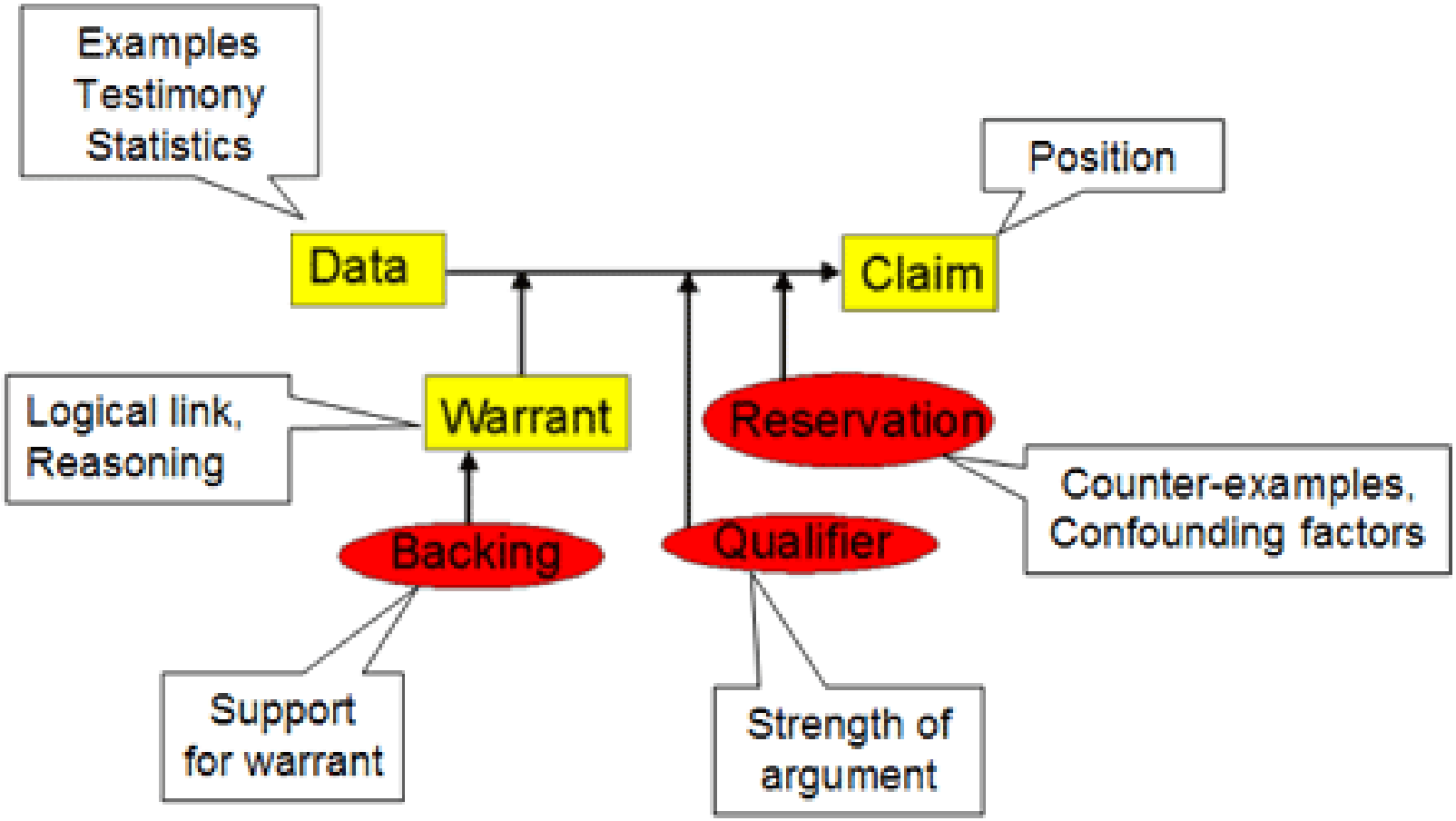
Toulmin model of argumentation

Stephen Toulmin,
British philosopher
1922-2009

Toulmin model

- **Claim**: the position or claim being argued for; the conclusion of the argument
- **Grounds**: data, reasons or supporting evidence that bolster the claim
- **Warrant**: the principle, provision or chain of reasoning that connects the grounds/reason to the claim
- **Backing**: support, justification, reasons to back up the warrant
- **Rebuttal/Reservation**: exceptions to the claim; description and rebuttal of counter-examples and counter-arguments
- **Qualification**: specification of limits to claim, warrant and backing. The degree of conditionality asserted

Toulmin diagram



Claim 2: Warrants, grounds and backings vary across:

- Scientific disciplines
- Regulatory contexts
- Worldviews / political beliefs

What are the main warrants in use for causal inference; thus what data is being generated through research?

- Epidemiology — Hierarchy in methods, RCT; Bradford Hill Criteria
- Toxicology — Mode of Action informs risk assessment; Mixtures matter
- Ecology
- Economics — The market is always right; Consumers make rational choices
- Medicine
- Public Health — Prevention is always cheaper than treatment

Some more warrants-claims

- Late lessons of early warnings: It went wrong in the past with DDT, and asbestos, so I worry that EMF, nano, etc. are not safe
- Risk regulation stifles innovation
- My scientific discipline is of higher value and more important for risk assessment, than yours, ergo needs more funding
- You call it a crop protection product, I call it a poison
- Scientist should not get involved in public debates
- It’s not about the risks, its about trust in the risk assessment/assessors

What are the main warrants in use; thus what data is being generated through research

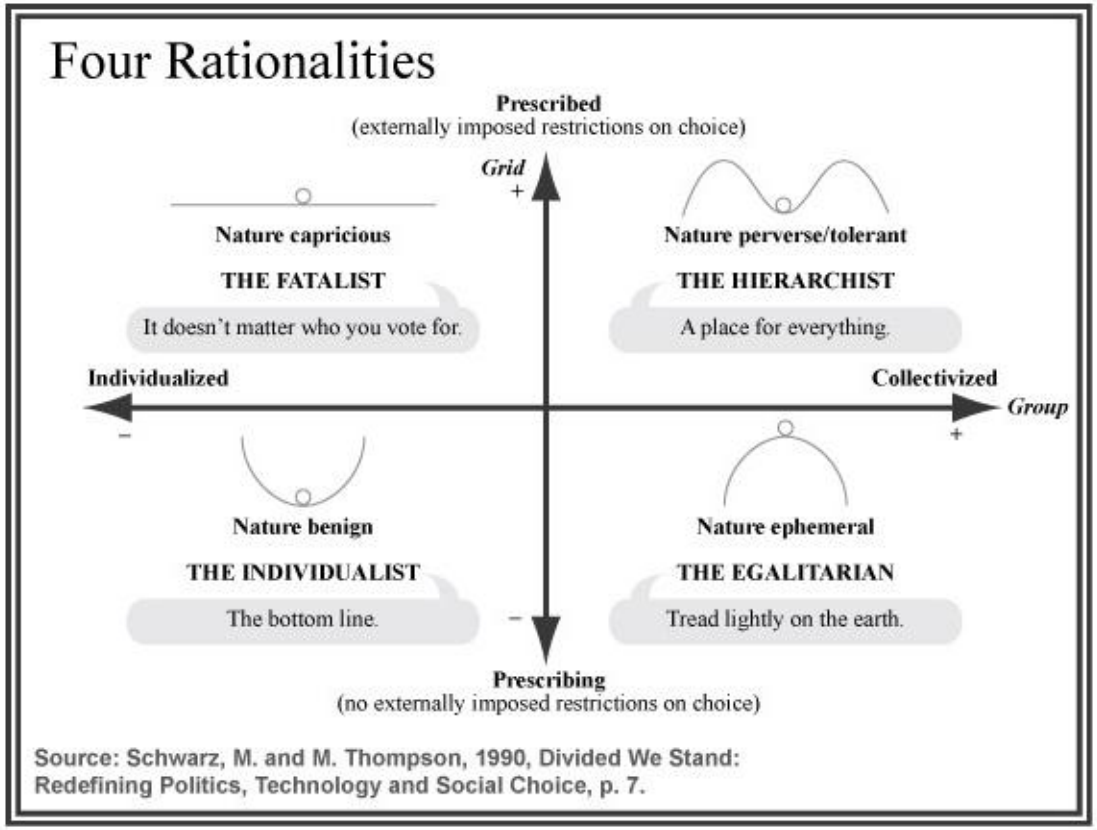
- Risk assessment of toxic substances
- Risk assessment of radiation
- Risk assessment of ambient air pollution
- Risk assessment in occupational settings
- Risk assessment of pharmacuetical products
- Risk assessment for food safety

What are the main warrants in use in different expert roles?

- Pielke
  - Pure Scientist
  - Science Arbiter
  - Issue Advocate
  - Honest Broker

- Weiss
  - Science Absolutist
  - Technological Optimist
  - Environmental Centrist
  - Cautious Environmentalist
  - Environmental Absolutist

What are the main warrants in use in different worldviews?

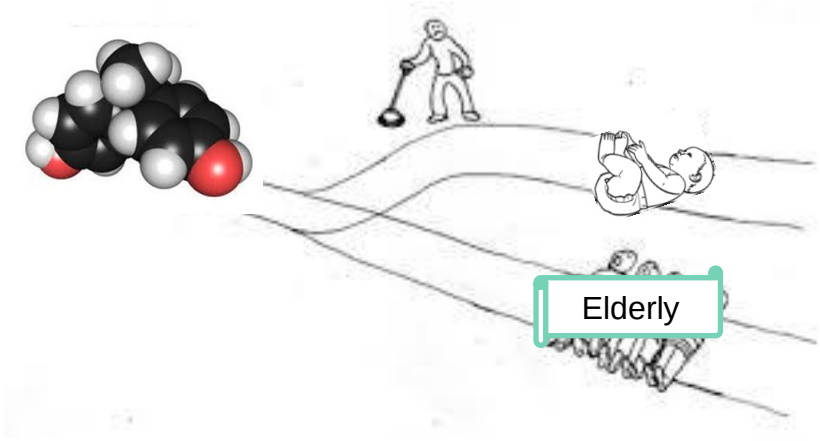


Source: Schwarz, M. and M. Thompson, 1990, Divided We Stand: Redefining Politics, Technology and Social Choice, p. 7.

What are the warrants used in different countries to regulate EMF (ELF, RF, ambient/occupational, EHS)

- France
- UK
- Germany
- Belgium
- Sweden
- Netherlands

Trolley problems (after Philippa Foot, 1967)



Should you pull the lever?

Should you push the fat man?

Pictures from falkenblog.blogspot.com, blog.mvonederland.nl and creative commons

In conclusion

- We need good science to address good questions
- There is no ‘utility free’ answer to the question “What science for which questions”
- We need better understanding of the warrants in play in risk assessment, management and governance
- Practice of professional humility may help build trust
- Looking at the question behind the question may allow us to find the right mix of scientific disciplines and forms

The one-handed scientist is not the solution

- **Scientist controls colleague's hand in first human brain-to-brain interface** **(Cnet News, Aug 27, 2013)**

Questions?