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Resilience lessons for Australian Climate Change Mitigation Policy

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"Prediction is very difficult, especially about the future" – Niels Bohr

In areas characterized by deep uncertainties,
can we, or should we, avoid the prediction game?

Outline

- Uncertainty
- Robustness and resilience – concepts and frameworks
- Strategies to improve robustness of climate policy

One possible taxonomy of uncertainty

	Weak Uncertainty	Strong Uncertainty	
	Risk	Ambiguity	Fundamental Uncertainty
Characteristics	Possible outcomes are known, and the probability distribution of outcomes is well characterised.	Possible outcomes are known, but the probabilities of such outcomes are not well characterised.	Neither outcomes nor their probabilities are known.
Other terms	Probabilistic risk, Knightian risk, Savage uncertainty, weak uncertainty, known knowns.	Knightian uncertainty, grey swans, known unknowns.	Deep uncertainty, radical uncertainty, severe uncertainty, ignorance, black swans, unknown unknowns.
Tools and Frameworks	Expected utility theory, Bayesian statistics, portfolio optimization, Monte Carlo simulation.	Traditional scenario analysis, computational multi-scenario simulation, learning models/simulations, imprecise probabilities, fuzzy sets, robust control theory, belief functions, certainty factor, info-gap.	

Another uncertainty distinction

- Epistemic uncertainty
  - is that uncertainty resulting **from incomplete information or limits on cognitive capacities** to process information. At least some of this type of uncertainty can disappear as knowledge becomes more complete and adequate.
- Aleatory uncertainty
  - the random or, some would say**, inherent or irreducible uncertainty** of the system under study. This can arise from human creativity but is also a feature of complex adaptive systems.
  - In its most pure form, with this type of uncertainty no amount of analysis or information will ever eliminate all the uncertainty, making delay futile.

Mainstream integrated assessment climate modeling

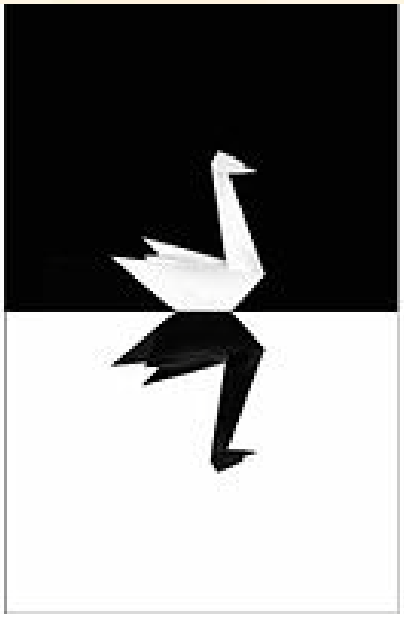
- The economics of climate change mitigation has mostly continued along traditional cost-benefit welfare analysis based on expected utility maximization
  - DICE (Nordhaus 2007) and FUND (Tol 1999) are deterministic models that maximise the discounted present value of welfare (based on consumption) by choosing an emissions trajectory
- But even Savage himself took a cautious approach to his theory, suggesting that it should only be applied to small worlds
  - ie ones in which it is possible to ‘look before you leap’, i.e. imagine every possible contingency, including their probability of occurrence.
- Weitzman (2009) on implications of fat tail distributions.

If traditional optimizing is not sensible under these uncertainties then what are we to do?

- Robustness approach

- Nasim Taleb of ‘Black Swan’ fame:

  “In the black swan world, optimization isn't possible. The best you can achieve is a reduction in fragility and greater robustness. You may have heuristics, but not an optimization rule. I hope the message will finally get across because I haven't succeeded yet. People talk about black swans but they don't talk about robustness, which is the real lesson of the black swans” (Wharton, 2011).



Robustness – concepts and frameworks

Features of the robustness approach

- A robust decision or policy is one that has *the ability to perform reasonably well under a wide range of possible futures.*
  - contrasts with what may be called a brittle or fragile decision or policy – one that may be optimal for a given predicted future but that performs poorly under other possible scenarios.
- Satisficing instead of optimising
- Emphasizes vulnerabilities rather than hide them
  - RAND Corporation describe their approach to analysing robustness as a 'vulnerability-and-response-option' framework, as opposed to the 'predict-then-act' framework of traditional decision-making under uncertainty

Features of the robustness approach (cont)

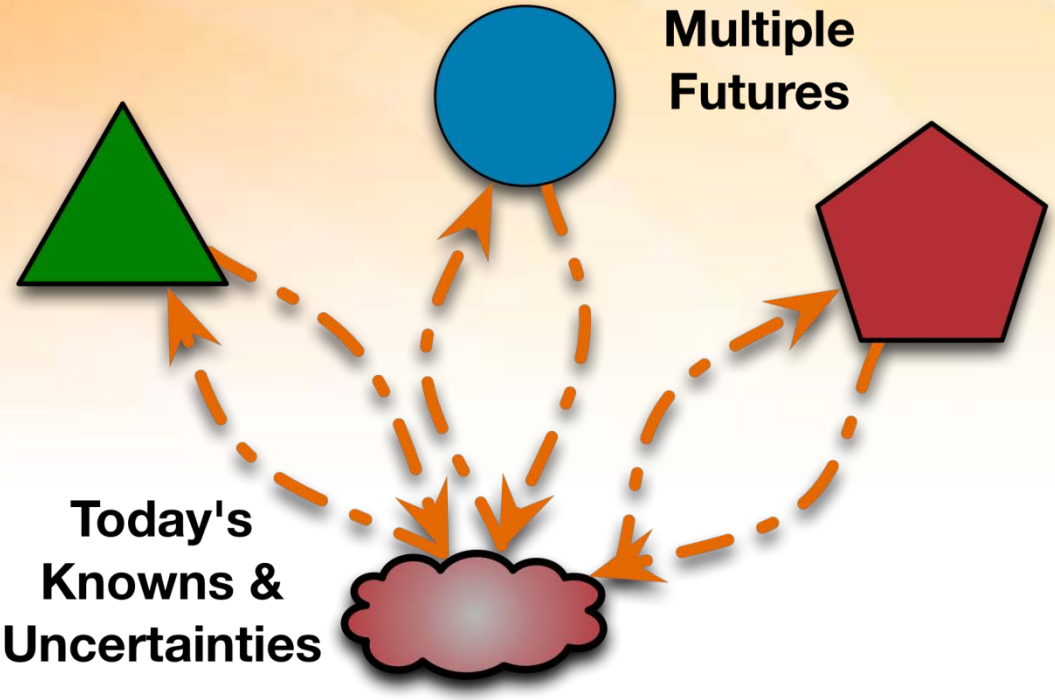
- Common strategies used to build decisions or policies that are less vulnerable to different futures (and often found in nature):
  - Resistance or buffering
    - or armouring. Building a sufficient level of capacity to automatically handle or absorb any shocks.
  - Resilience
    - impacts may have a temporary effect but there are sufficient in-built capacities to return to the original state
  - Redundancy
  - Diversity
  - Flexibility and adaptability
    - having the ability to modify strategies and plans to achieve a better outcome as one learns more about the issues at hand and how the future is unfolding

Frameworks and tools used in robustness approach

- Traditional scenario analysis
  - the development and use of plausible narratives about how the future will unfold.
- Computational multi-scenario simulation
  - A more comprehensive and quantitative approach to generating and evaluating robust strategies under multiple scenario.
    - often hundreds or thousands of plausible futures are examined using different distributions or model structures.
    - An interative process of identifying a small set of strategies that perform well across a range of scenarios and then seek ways to improve them across vulnerabilities
- Other
  - imprecise probabilities, fuzzy sets, robust control theory, belief functions, certainty factor, info-gap.

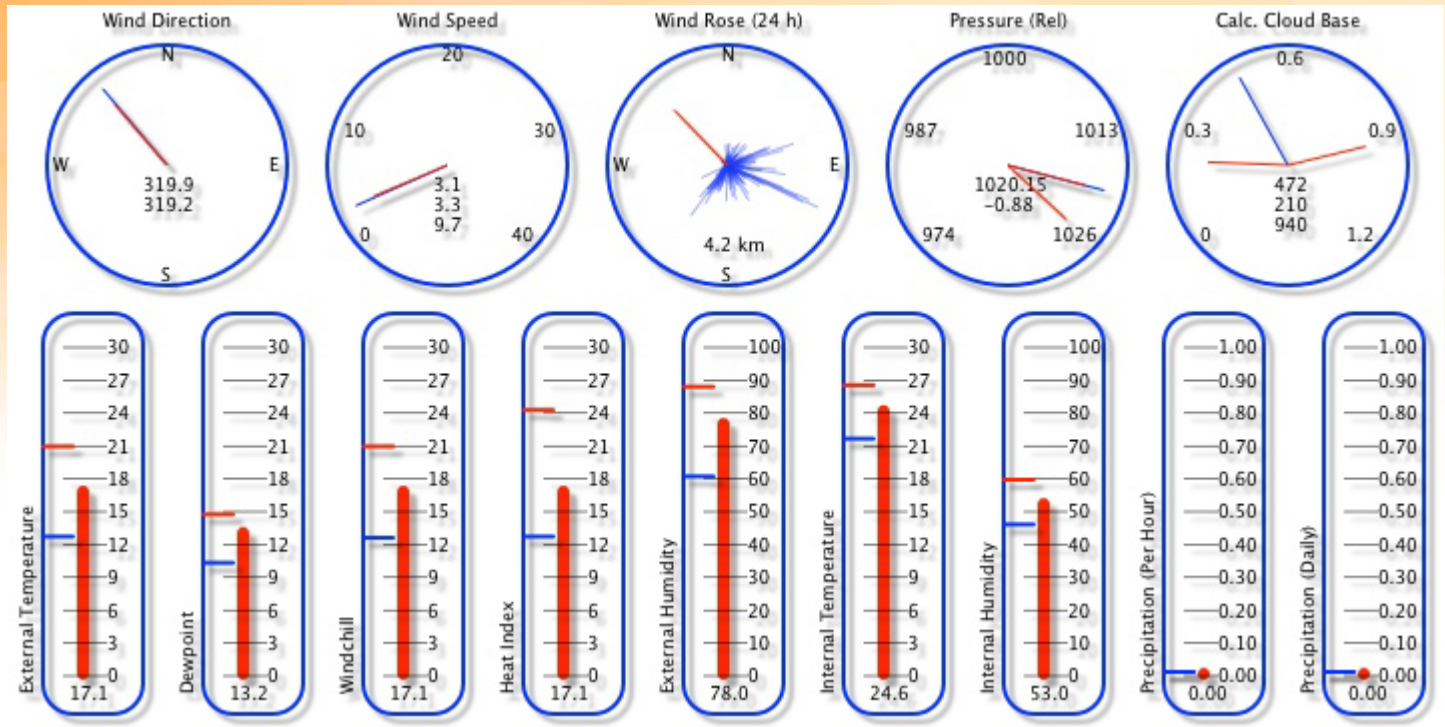
Strategies for improving robustness in climate policy
- lessons from the resilience literature

1. Incorporating scenario thinking into policy design



- Consider candidate policies under a wide range of plausible futures and focus attention on the vulnerabilities and key factors that affect the policies' performance

2. Built-in policy adjustment



- The establishment of a set of ‘signposts’ to monitor uncertainties that can be loosely anticipated (ambiguity)

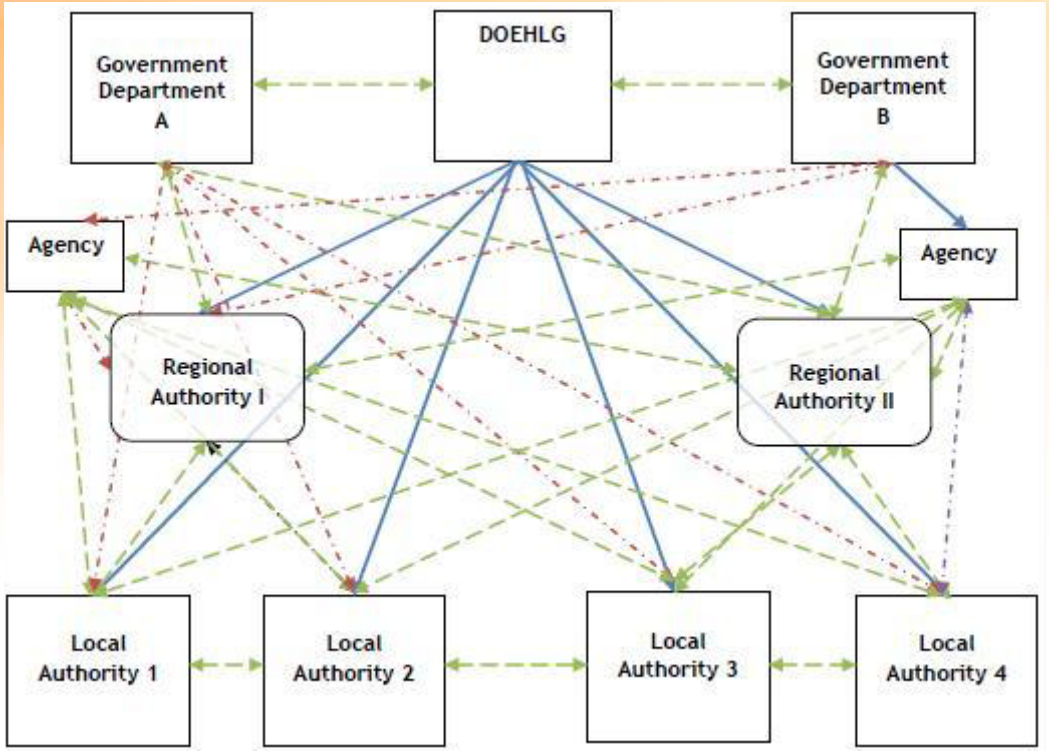
3. Policy review and learning

- Establishing, from the outset, review processes to examine the performance of the policies, and procedures to learn from experience with the policy.

4. Multiple policy instruments and diversity in options

- A portfolio of options provides a capacity to absorb shocks and greater flexibility to adapt quickly to new circumstances as they emerge.
- Policy instruments can fail unexpectedly, and having other mechanisms in operation can buffer against such failure.

5. 'Polycentric' governance



- Elinor Ostrom. Governmental units both compete and cooperate, interact and learn from one another, and responsibilities at different governmental levels are tailored to match the scale of the public services they provide

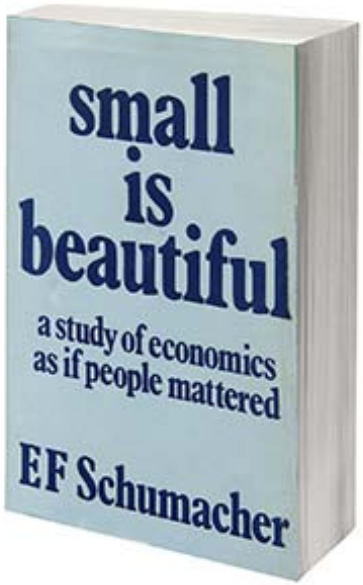
6. Multi-stakeholder deliberation

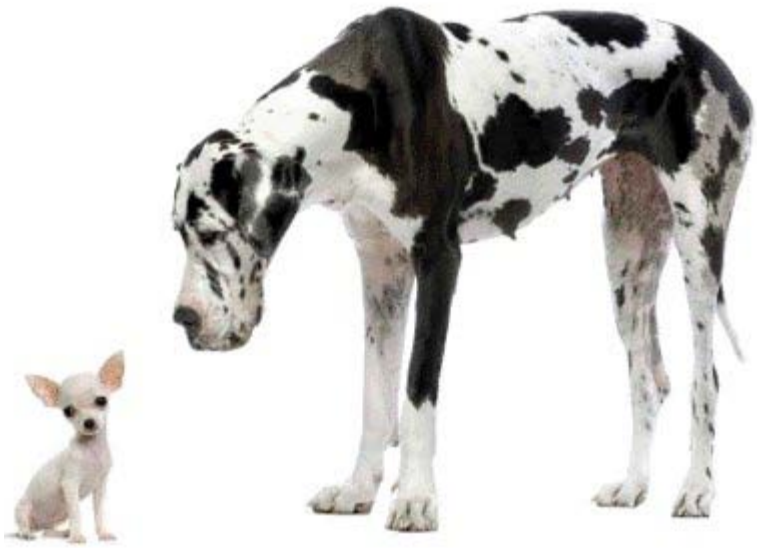
- maximising the involvement of stakeholders can provide useful information, knowledge, and innovative perspectives, and a greater understanding is provided of the values and social priorities that are held by the public

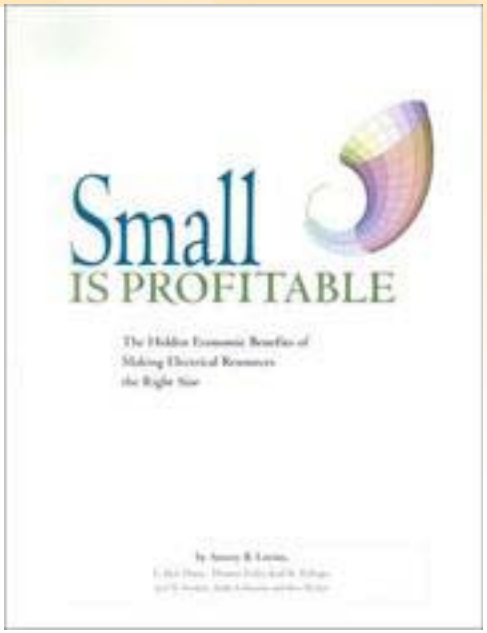
7. Facilitating networking and self-organisation

- Self-organisation through social networks can respond to stresses or shocks to a system, leading to solutions without the need of formal governance structures

8. Modular, reversible, and shorter-lived investments







- Investment decisions today may lock in infrastructure that will take decades and be difficult – or very costly – to reverse, should they turn out to be a wrong path.

Conclusions

- Once-and-for all policies based on conventional, bell curve, measures of quantitative risk probably does not fit the bill with climate change.
  - A complex, dynamic, multi-layered, and contextually contingent world requires different ways of thinking about decisions and policy making.
- The robustness approach attempts to liberate decision-making from relying on precise predictions of the future
  - and shifts the emphasis towards developing policies that can more reliably achieve the desired outcome under a variety of potential conditions.
  - Rather than focusing on the age-old question of “What will the future bring?”, the robustness approach attempts to address the more relevant question of “What actions can we take today to better shape the future to our liking?”

Conclusions (cont)

- It's hard to detect if Australia's climate policy development has been shaped by robustness considerations.
  - Some of the generic strategies could help in this direction
  - It may help decision-makers use available scientific and socio-economic information to distinguish a set of reasonable policies from unreasonable ones and to understand the tradeoffs implied by choosing among the reasonable ones.
  - And many of the above strategies may help cope with surprises (unknown unknowns).
- Developing robustness in policies is not always inexpensive, future research will be required to understand the value of having more robust policy.

Thank you