
February 15, 2015



Ministry of Defence

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# Planning for an uncertain future

**Calculating and Communicating Uncertainty conference**

**27th January 2015**

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MOD Strategy & Capability Research Programme

Image from Paul Lucas, Wikimedia Commons

# The challenge: How to make decisions today to have an effect in 10-20 years, while the world changes?

- Many policies take years or decades to achieve effect, but need commitment in advance
- Lengthy investment programmes take decades to complete and operate
- Large organisations take months or years to make substantial changes
- Many decisions taken today constrain future flexibility
  - Contractual reasons
  - Limited budgets

Images from Parliament.uk, Gov.uk and Defence Imagery

# This introduces pressure to act before uncertainty can be reduced

| Locations of uncertainty |
| --- |
| **Context:** What situations might we find ourselves in? |
| **Values:** How important is it to be effective in each situation? |
| **System model:** How will the future system respond to external forces and policy measures in each situation? |
| **System outcome:** What effect will each of our policy measures have in each situation? |

Modified from Walker, 2013

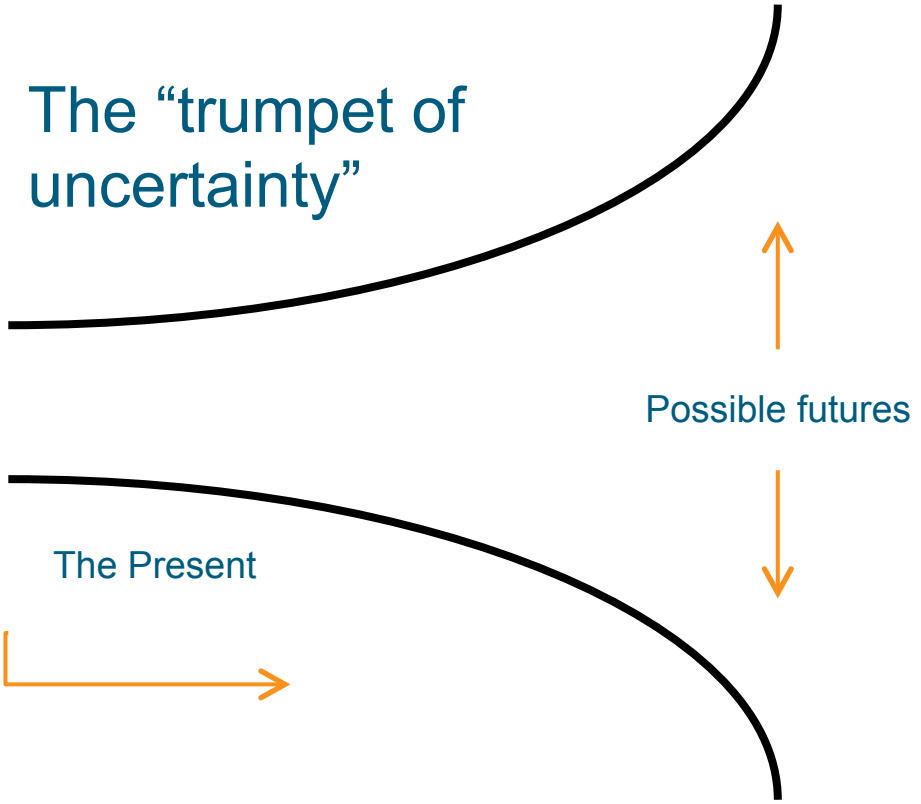


Figure adapted from Rosenhead, 2001

# For some Defence and Security policies these issues are particularly challenging

| Locations of uncertainty | Causes of uncertainty | How we deal with them |
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| **Context:** What situations might we find ourselves in? | **Insurance policies:** We respond to unpredictable geopolitical events | Scenarios |
| **Values:** How important is it to be effective in each situation? | **Debate** over the benefits and costs of using military force | Planning assumptions |
| **System model:** How will the future system respond to external forces and policy measures in each situation? | | |
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| | **Decisions can take decades to have effect:** How well will future systems perform? | Engineering models and intelligence |
| | | |

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| | **Decisions can take decades to have effect:** How well will future systems perform? | Engineering models and intelligence |
| | **Complexity:** We do not have established theories for the impact of some of our policies: e.g. influence | Research into behavioural aspects of conflict |

# Walker et al describe 5 levels of uncertainty

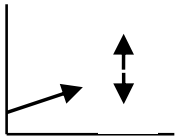
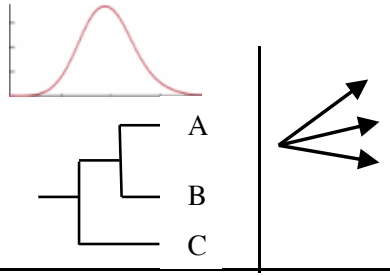
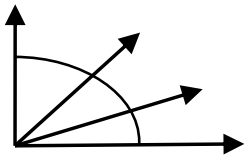
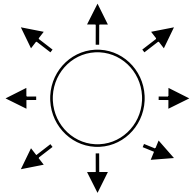
| | Level 1 | Level 2 / 3 | Level 4 | Level 5 |
|---|---|---|---|---|
| **Context** | A clear enough future (with sensitivity)  | A few alternative futures   | A multiplicity of plausible futures (unranked)  | A multiplicity of futures, incl. black swans  |

Figure adapted from Walker, 2013

Longer term planning

Number of dimensions to the problem & uncertainty in each

# Much Defence strategic planning involves context uncertainty between Levels 4 & 5

| | Level 1 | Level 2 / 3 | Level 4 | Level 5 |
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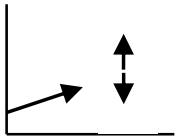
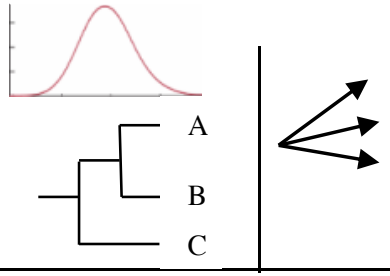
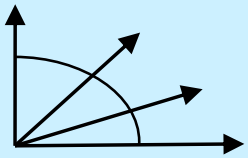
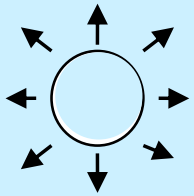
| **Context** | A clear enough future (with sensitivity)  | A few alternative futures   | A multiplicity of plausible futures (unranked)  | A multiplicity of futures, incl. black swans  |

- Multiple dimensions to the nature of the tasks we will face
  - What? Where? Why? With whom? Against whom? How? How quickly?
- Poor data and models with which to predict the likelihood of these tasks
  - Uncertainties, not risks
  - Trends in the nature of tasks are discernible, but the path from one task to the next is random
- Adversaries change the rules and type of conflict to their advantage
  - With a reactive Defence policy, we cede a large degree of control to the adversary

# Different planning approaches are suitable for each level of uncertainty

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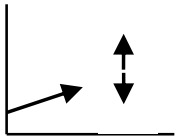
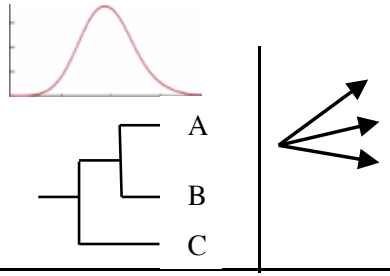
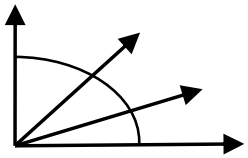
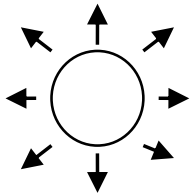
| **Context** | A clear enough future (with sensitivity)  | A few alternative futures   | A multiplicity of plausible futures (unranked)  | A multiplicity of futures, incl. black swans  |
| **Recommended approach** | Predict and act | Expected outcomes / Decision Analysis | | |
| **Use of scenarios** | Single "predictive" scenario with sensitivity analysis | Small set of "predictive" scenarios, weighted by probability | | |

Prediction

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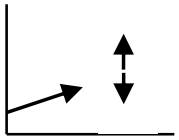
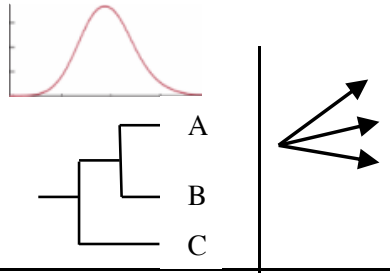
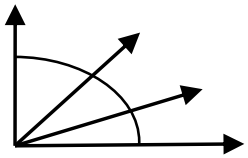
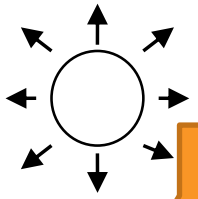
| **Context** | A clear enough future (with sensitivity)  | A few alternative futures   | A multiplicity of plausible futures (unranked)  | A multiplicity of futures, incl. black swans  |
| **Recommended approach** | Predict and act | Expected outcomes / Decision Analysis | Static robustness | Resistance |
| **Use of scenarios** | Single "predictive" scenario with sensitivity analysis | Small set of "predictive" scenarios, weighted by probability | Multiple "explorative" scenarios, aiming to "span" plausible futures | Worst case scenario |

Planning for the worst case

Planning for a wide range of futures

Prediction Exploration

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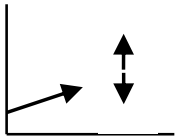
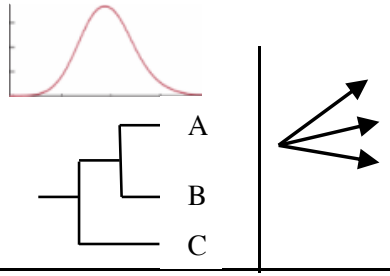
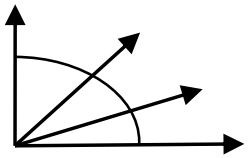
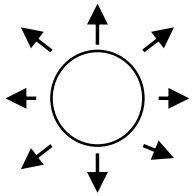
| **Context** | A clear enough future (with sensitivity)  | A few alternative futures   | A multiplicity of plausible futures (unranked)  | A multiplicity of futures, incl. black swans  |
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Ability to recover after shocks

Ability to sense and adapt to shocks

Prediction Exploration Adaptation

# Which planning approaches are suitable for Levels 4 and 5?

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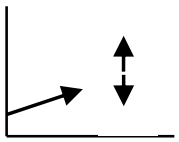
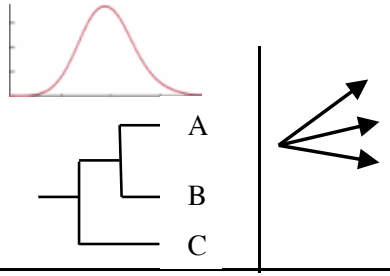
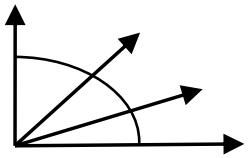
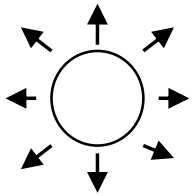
| **Context** | A clear enough future (with sensitivity)  | A few alternative futures   | A multiplicity of plausible futures (unranked)  | A multiplicity of futures, incl. black swans  |
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Prediction Exploration Adaptation

# Robustness through exploration for Level 4: Exploratory Analysis & Robust Decision Making

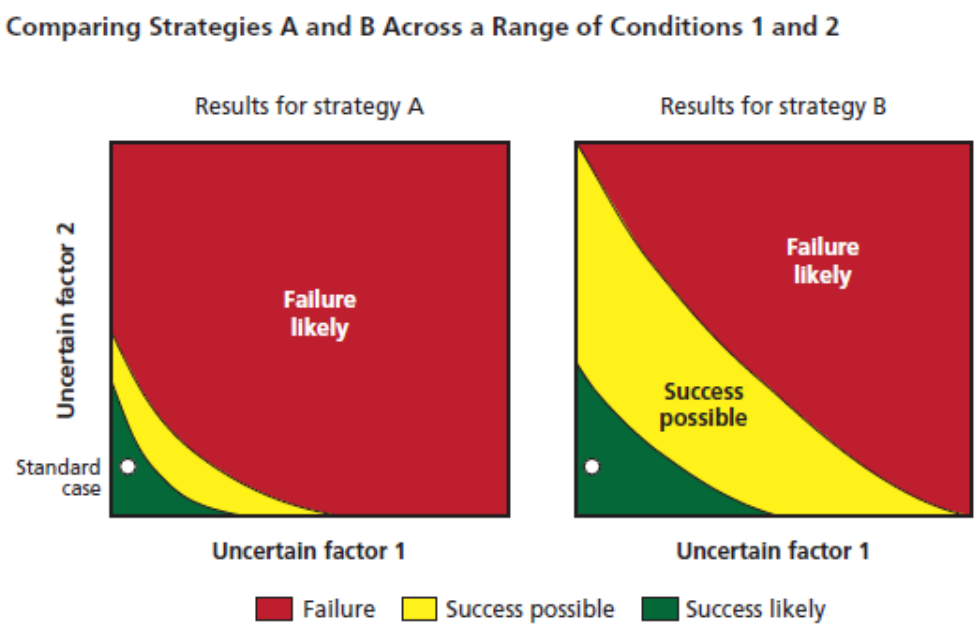



Figure from Davis, 2012

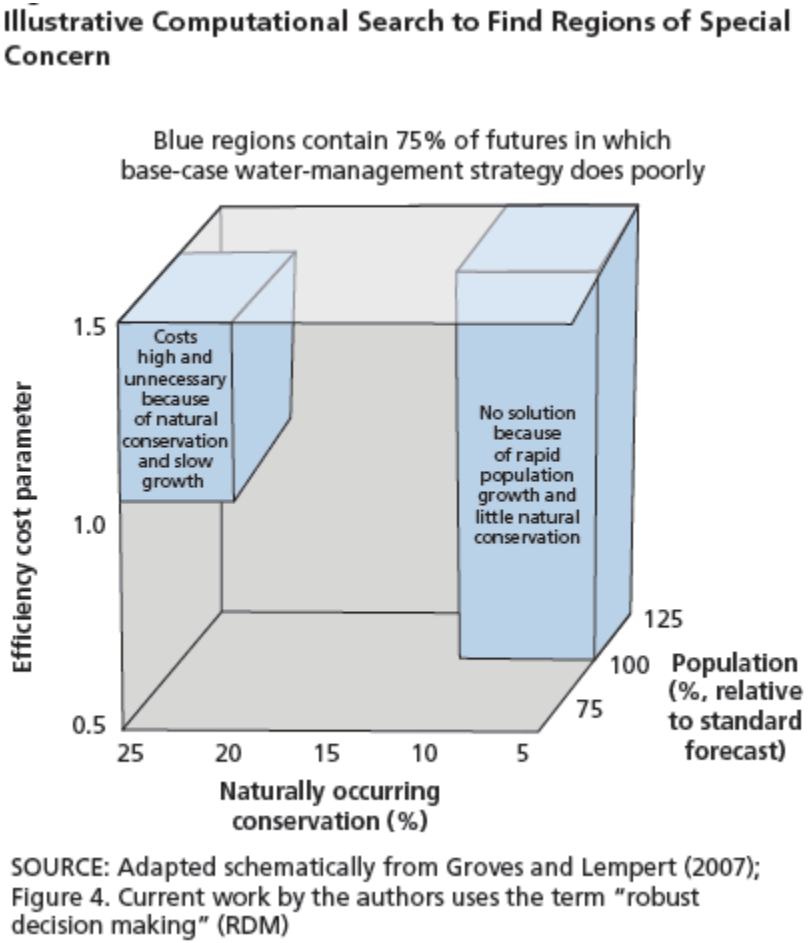
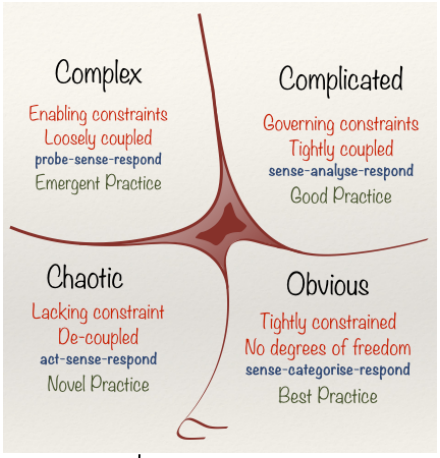



Figure from Davis, 2012

# Robustness through adaptation for Level 4/5: Various approaches have been proposed

- Requisite variety
- Design: exploratory-enquiry (Kingsmill, 2013)
- Experimentation
- ‘Muddling through’
- Frequent, numerous decisions (Doerner, 1997)
- Probe-sense-respond or act-sense-respond (Snowden, 2007)
- **Robustness** methodology (Rosenhead, 2001)
- **Robust Decision Making** (Groves, 2007)
- **“FARness”** analysis (Davis, 2013)
- **Dynamic Adaptive Policymaking** (Walker, 2013)




Source: Wikipedia

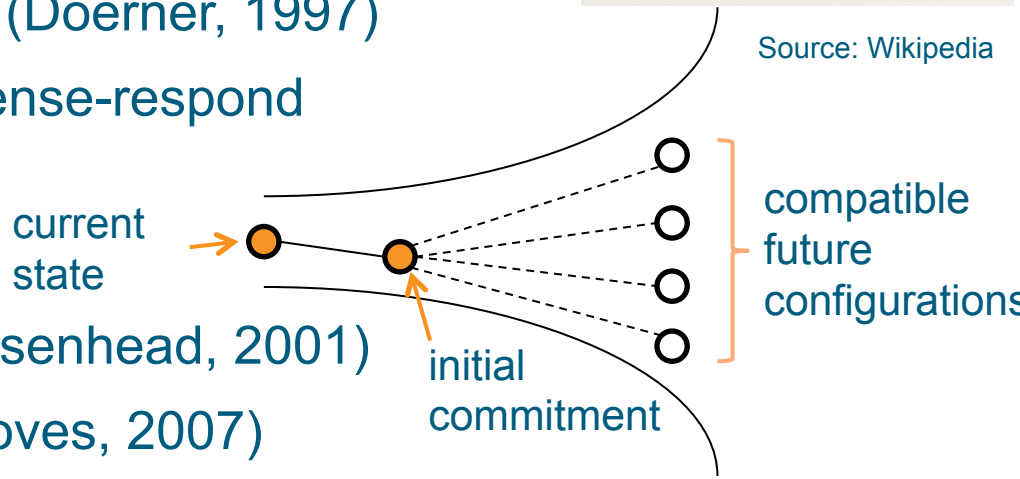



Figure adapted from Rosenhead, 2001

# Strategies for planning for an uncertain future

| | Strategy | Suitable for which problems? |
|---|---|---|
| Prediction | Predict and act | Level 1 simple problems |
| | Expected outcomes / Decision Analysis | Level 2/3 problems constrained to one of a few futures |
| Exploration | | |
| | | |
| Adaptation | | |
| | | |

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| Exploration | Static robustness (planning for a wide range of futures) | Level 4 problems where system adaptation is slower than context, where problems can be described in a few dimensions |
| | Resistance (planning for the worst case) | Level 4/5 problems where system adaptation is slower than context, and where being hit by shocks is unacceptable |
| Adaptation | | |
| | | |

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| | Resistance (planning for the worst case) | Level 4/5 problems where sys slower than context, and whe shocks is unacceptable |
| Adaptation | Resilience (ability to recover after shocks) | Level 4/5 problems where sys slower than context, and whe shocks is acceptable |
| | Adaptive robustness (ability to sense and adapt to deal with shocks) | Level 4/5 problems where sys as fast as the context |

Methods widely known and used

Methods available but not widely used

Methods widely known and used

Methods not widely available or used

# So what have we missed?

- Workshop tomorrow morning
  - Comparing exploration and adaptation approaches

# References


1. Walker, W.E., V.A.W.J. Marchau, and J.H. Kwakkel (2013). “Uncertainty in the Framework of Policy Analysis”, Chapter 9 in W.E. Walker and W.A.H. Thissen (eds.), *Public Policy Analysis : New Developments*. New York: Springer.
2. Rosenhead, J. (2001). “Robustness Analysis: Keeping Your Options Open”, Chapter 8 in Rosenhead (ed.), *Rational Analysis for a Problematic World Revisited*, John Wiley & Sons, Chichester.
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9. Doerner, D, The Logic of Failure: Recognizing and Avoiding Error in Complex Situations. New York: Basic Books.


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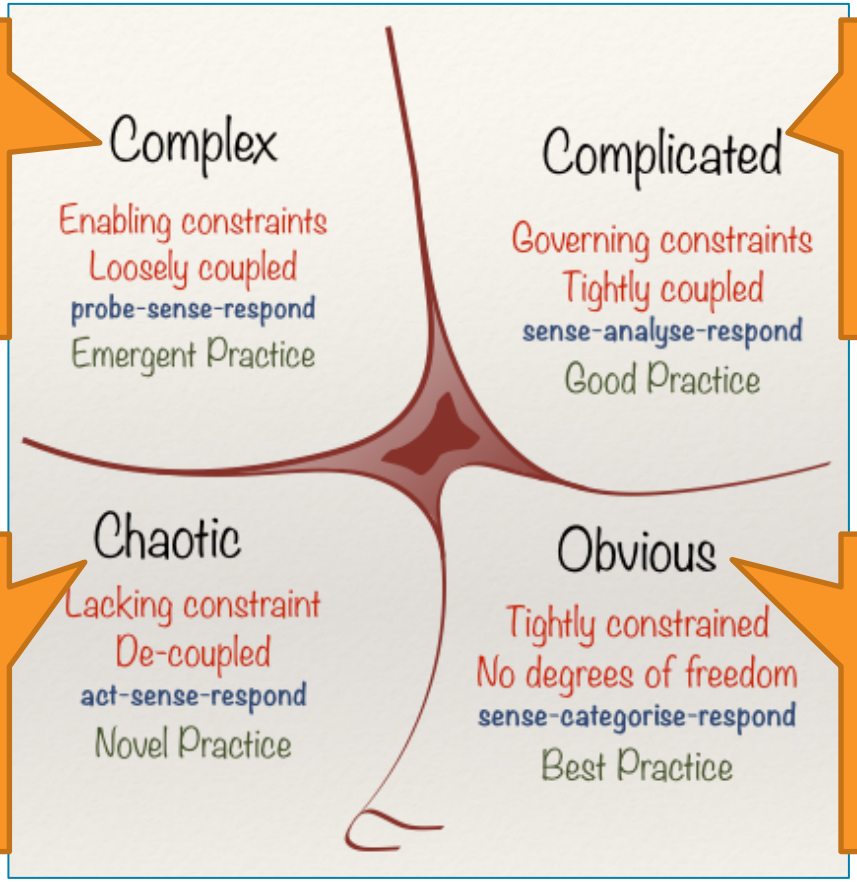
Ministry of Defence

# Abstract


- Many organisations are faced with the need to make decisions now that will take years to implement. Major investments (e.g. in transport infrastructure or military equipment) can take decades to deliver. The long delay between decision and implementation introduces a considerable degree of uncertainty for decision makers. How will the “requirement” change in that timescale? How well will the various proposed “solutions” perform? Other factors compound these uncertainties even further, particularly for policies aiming to achieve some kind of social or cultural change (e.g. reducing smoking or carbon footprint). For example, some regard efforts to predict how social systems, or even some complex technical systems, will respond to certain external stimuli as futile. Yet despite all this uncertainty, organisations still need to make decisions about what to do. This talk will explain how different analytical approaches can help organisations to plan for an uncertain future.

# Snowden suggests different techniques for managing problems by Cynefin domain

**Probe-Sense-Respond**
Unpredictable, so a "safe to fail" exploratory approach is suggested




**Sense-Analyse-Respond**
Amenable to conventional analysis

**Act-Sense-Respond**
Must be managed intuitively

**Sense-Categorise-Respond**
Amenable to checklists or recognition primed decision making