The Actuarial Profession
making financial sense of the future

GIRO conference and exhibition 2010
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Behavioural ERM and the ORSA

12-15 October 2010

Overview

- ORSA
- Introducing People
- Allowing for people in risk management

ORSA

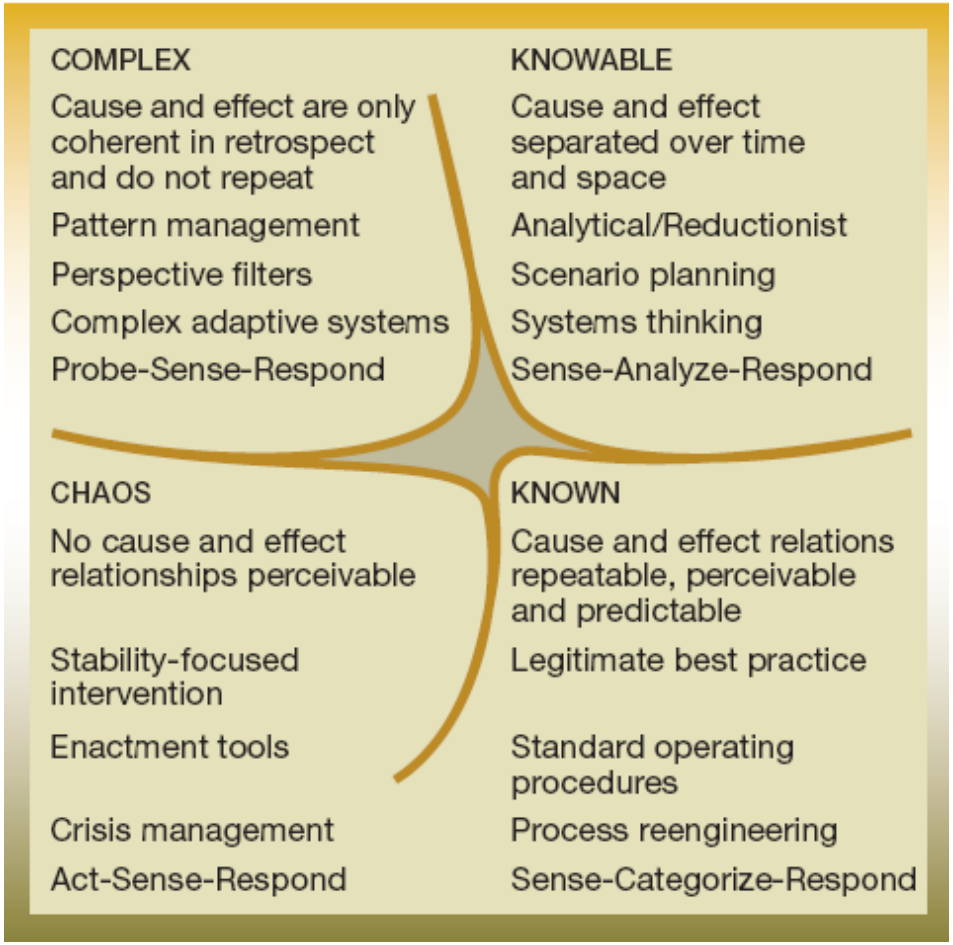
- Own **Risk** and Solvency **Assessment**
- Not just solvency
- Key items to consider:
  - Risk Profile
  - Emerging risk
  - Risk interactions
  - Forward looking

Introducing People

- Companies/markets are social structures
- ...of people
- Risk is an unintended consequence of what the people do
- People make things “complex”
- People are a poor risk-assessment device

The nature of risk

- Risk frameworks typically designed to monitor “known” and “knowable” risks
- Emerging risks tend to be “complex”
- Very different approach required for complex



Kurtz and Snowden 2003

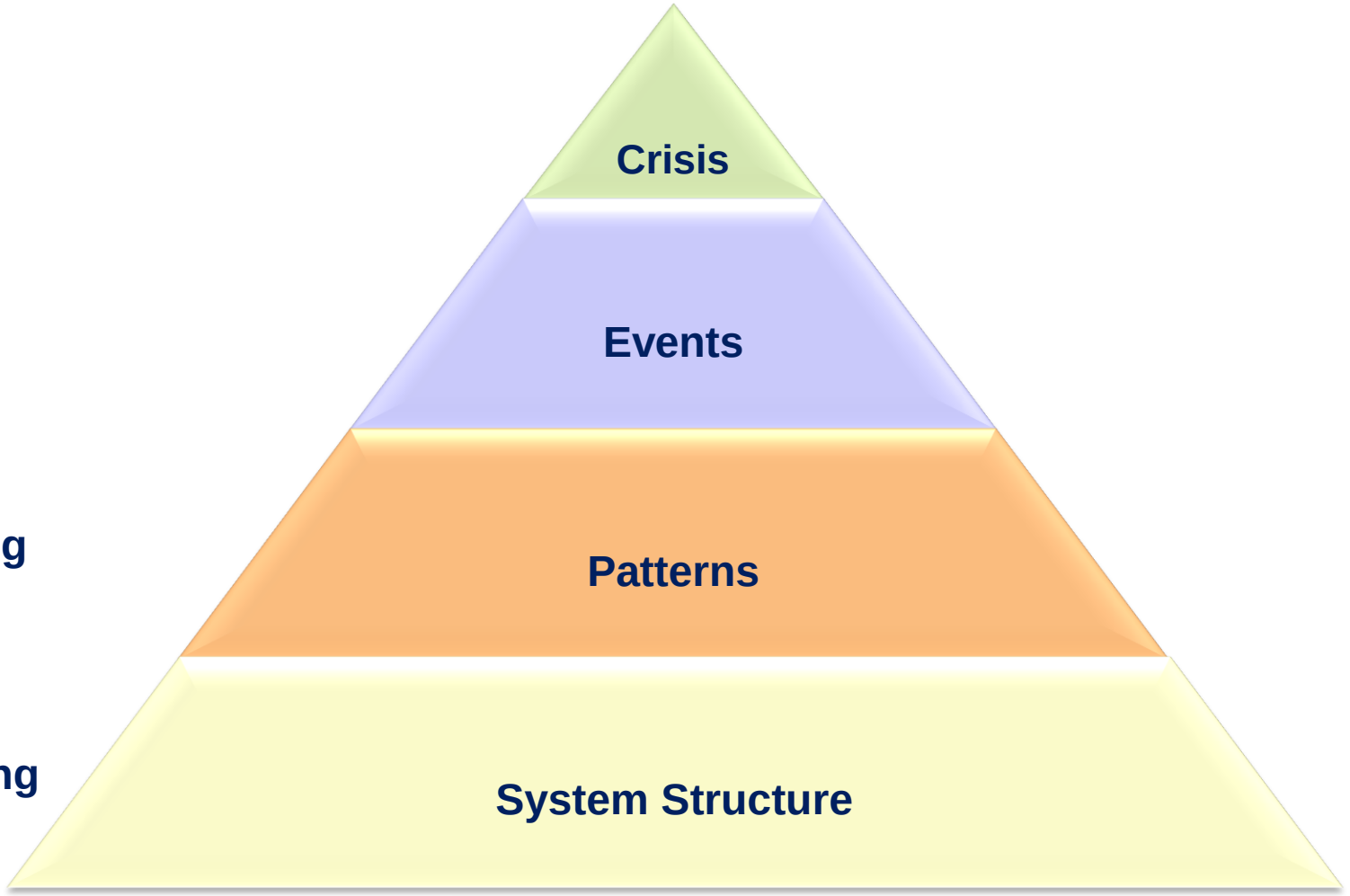
Why are risks hard to spot early?

Symptoms

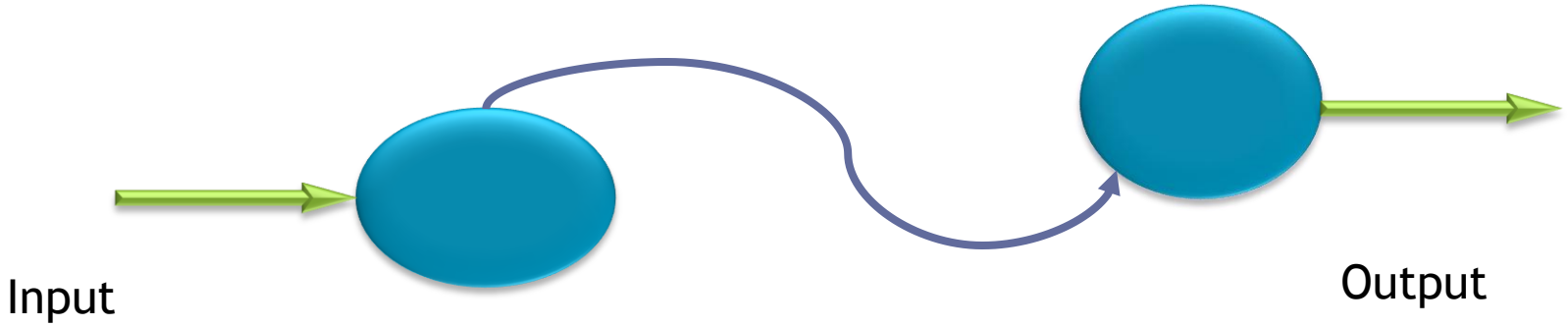
Causes

Sense-making

Understanding

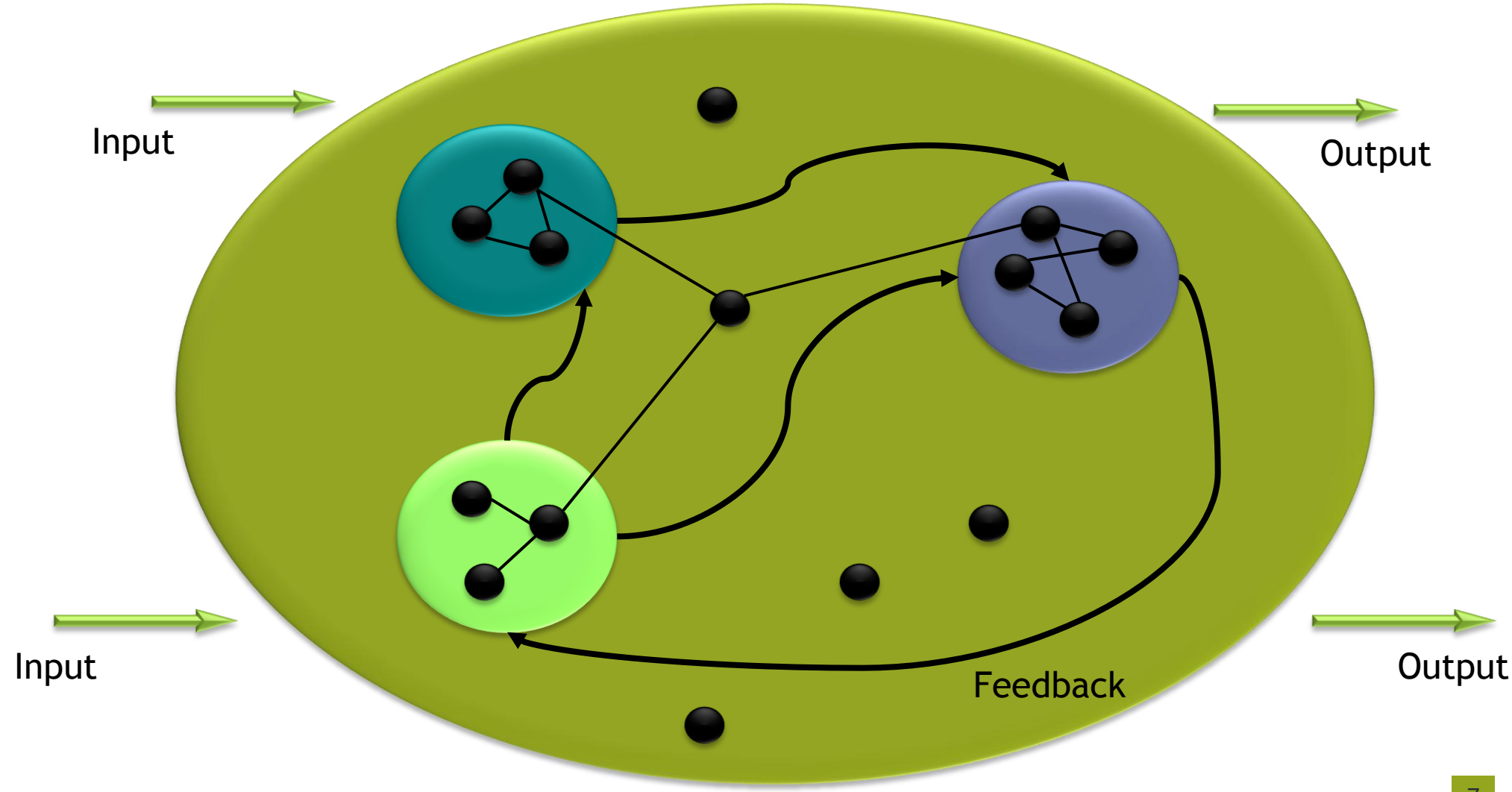


What is a system ?

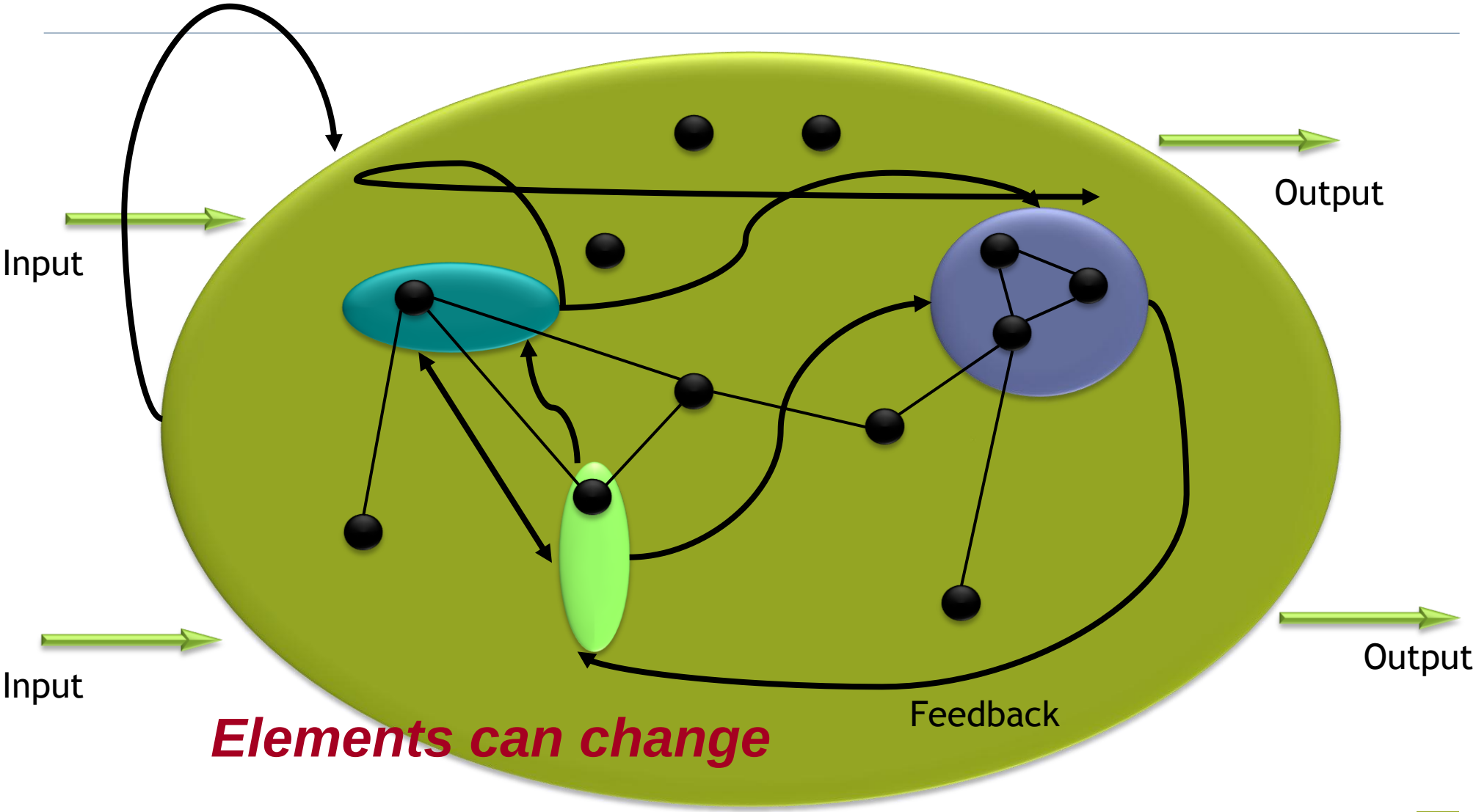


“a set of components interconnected for a purpose.”

What is a *complex* system ?



What is a complex *adaptive* system ?



Complex Adaptive Systems

- Basic properties:
  - Has a purpose
  - Emergence – the whole has properties not held by sub components
  - Self Organisation – structure and hierarchy but few leverage points
  - Interacting feedback loops – causing highly non-linear behaviour
  - Counter-intuitive and non-intended consequences
  - Has tipping point or critical complexity limit before collapse
  - Evolves and history is important
  - Cause and symptom separated in time and space

A Myth

- “Complex” does not mean “complicated”

2 bits of metal and two screws ⇒ Chaotic

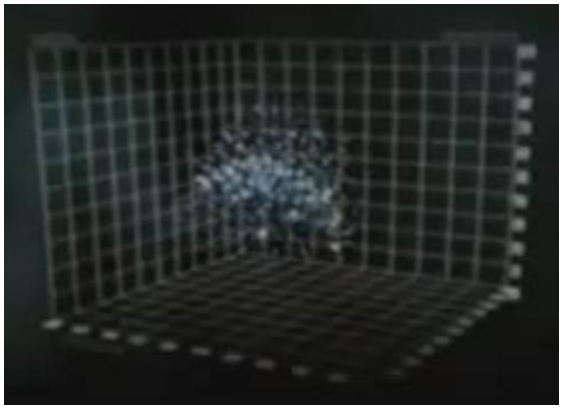
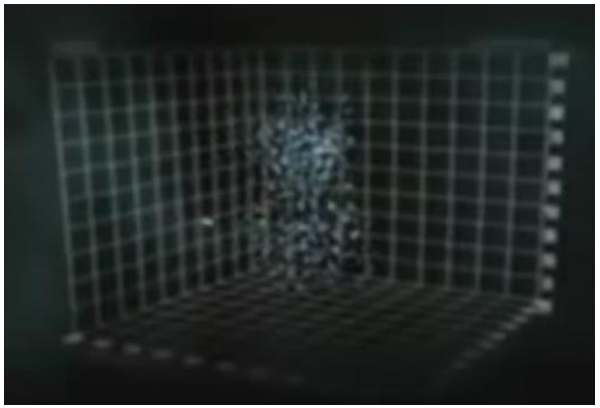
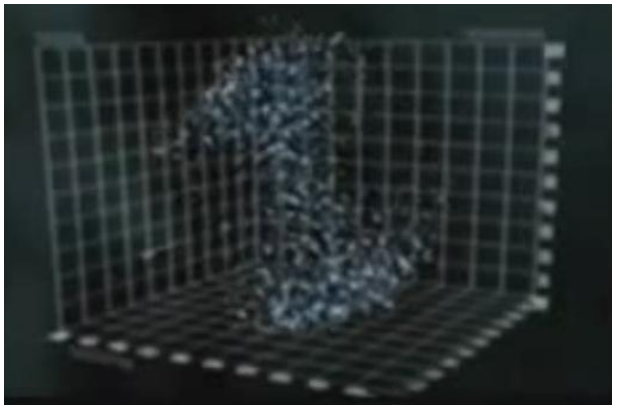
>150 intricate parts ⇒ Predictable

Example: Flocking / Shoaling



Modelling complexity need not be complex:

These highly complex behaviours can be reproduced quite accurately with 3 simple, interacting rules

Typical Tools

- Complex systems can be studied using tools like:

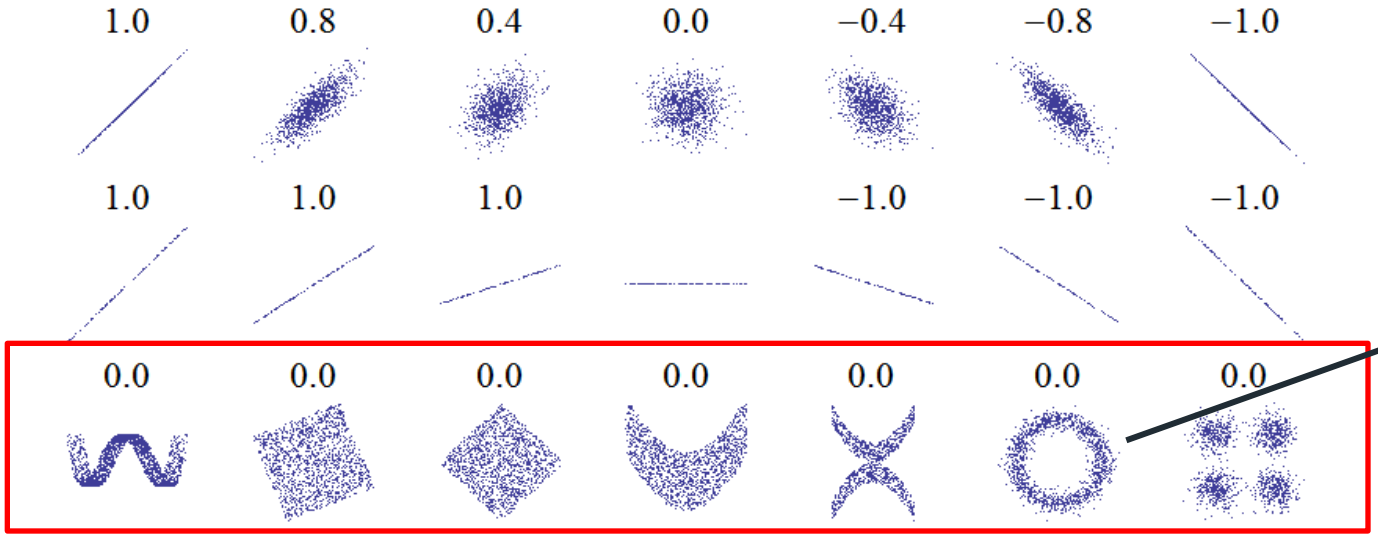
  Information/entropy

  - Information I(X) = -log $p(x)$
  - If something is “surprising” it shares a lot of information
    - $p(x)=0 \Rightarrow$ -log $p(x) = \infty$
  - If something is “expected” it shares little information
    - $p(x)=1 \Rightarrow$ -log $p(x) = 0$
  - Entropy H(X) = average information of system

Typical Tools

- Mutual Information

Different levels of correlation

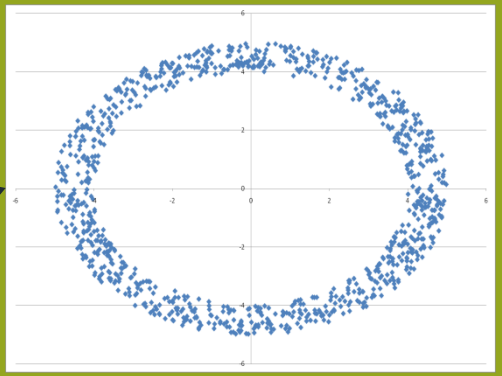


No correlation!

Example

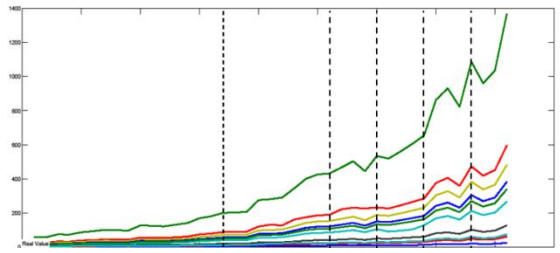
$\Theta \sim U[0,2\pi]$
$R \sim U[4, 5]$
$X = R \cos \Theta$
$Y = R \sin \Theta$

Sample of 1000



Correlation = 0.0
Mutual Info = 1.0

Typical Tools



Trend of SCR components looks stable over time...

..but uncertainty differs between components...

..and overall uncertainty changes over time...

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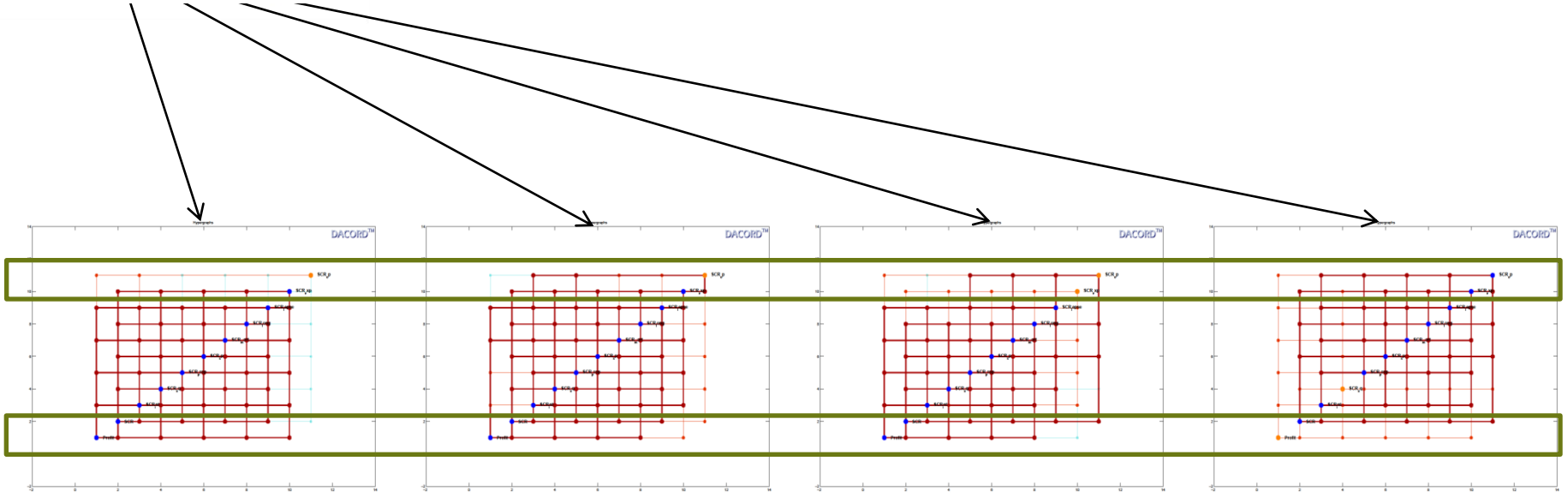
OpRisk gets more important

EqRisk gets less important



First result

- People mean companies are complex adaptive systems
- We now have access to tools which can help us find the emergent properties (risks) of those
  - Understanding of the system (e.g. Cognitive mapping)
  - Monitoring approaches (e.g. Use of entropy, complexity)
  - Simulation (e.g. Agent models, systems dynamics, adaptive models)
  - Identifying risk interactions (e.g. Mutual information)

People

- Typically things with “people” get simplified
  - Assume rational behaviour
  - Assume equilibrium reached (behaviours repeated)
- Reality
  - Mental models incomplete
  - Bounded rationality
  - Insufficient time to consider things
  - Unable to mentally rationalise feedback loops
  - Not in equilibrium

People (mis)behaving

- The weak link in risk assessment:
  - Humans cannot be rational even when they try to be
  - Even when they can be rational they aren't
  - Prefer to use other tools for decision-making (emotion, gut feel, suspicion)

"How do humans reason in situations that are complicated or ill-defined? Modern psychology tells that as humans we are only moderately good at deductive logic, and we make only moderate use of it. But we are superb at seeing or recognising or matching patterns – behaviours that confer obvious evolutionary benefits. In problems of complication, then, we look for patterns."

Brian Arthur "Inductive reasoning and bounded rationality" American Economic Review 84 #2 (1994)

People (mis)behaving

- Also relevant for emerging risk:
  - People are poor at assessing probability (especially conditional)
  - Mental models bias towards optimism $\Rightarrow$ hard to see need for change
  - Natural bias towards loss aversion $\Rightarrow$ asymmetric assessment of risk
  - Mental models become increasingly effective in a stable environment at the expense of flexibility
  - Stable environments naturally select resources with skills optimised for that environment rather than flexibility
  - Cultural norms a big influence on behaviour
  - Threshold for “following the crowd”

Second result

- A risk framework must compensate for human nature
  - Data driven where possible
  - Test opinion against observation
  - Proactively reduce bias in assessment
  - Set the right cultural environment

Summary

- The presence of “people” introduces two challenges:
  - It makes risk “complex”
  - It makes risk assessment and management difficult
- Concepts and tools from complexity science can help deal with emerging risk, risk interactions and describing the risk profile
- Concepts and tools from social science and psychology can help to reduce bias and improve risk management

The problem with people is that they're only human.

Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the presenter.