Key Concepts in Systems Thinking

for students, voters, journalists and politicians.

J F Evans

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DEDICATION

To all the clients and students, owners, managers, staff and customers, at all the organizations and disorganizations it has been my joy to work with.

Chapter 1

Some Necessary Background

We are so used to our 'normal' way of thinking that we tend to take it for granted, as we do with most 'normal' things.

The post-enlightenment scientific/technical revolution achieved amazing things, but as a consequence, we became a bit too pleased with our thinking abilities. We over-estimated the scope and effectiveness of our 'rational' abilities and under-valued all other thinking modes.

When we started trying to get computers and robots to do seemingly simple human-like **thinking** and **decision making**, we began to realize just how subtle, complex and varied human thinking can be.

We had to look again, through the eyes of a blank-slate, uneducated, untrained, inexperienced robot, at the fundamentals of human thinking; how we perceive and interpret (model) the world, recognize different contexts, make context-sensitive decisions, juggle priorities and jiggle resources, avoid dangers, set and chase goals, communicate, cooperate, compete, and learn - or not.

Now that **evolutionary psychology** has been taken off the taboo list, it too can join in the fun, working hand in hand with **traditional scientific paradigms**, leading us into interesting and fruitful new areas of exploration, where we can shed **the light of reasonable speculation** on the **forces and compromises** that gave rise to the **strengths and weaknesses** in our current evolved **thinking** and **moral repertoires.**

This collaboration (evolutionary psychology and traditional science) has highlighted **significant differences** in the way we behave when we are thinking and acting;

- as an **individual** (what shall we call it? **I-think**), and
- as **part of a group** (**Group-think**).

How did this difference come about?

Multilevel Selection Theory
says that natural selection takes place at multiple levels;

- **gene level** - selection between genes within an individual,
- **individual level** - selection between individuals within a group,
    - Selection between individuals within a group favours intelligence, competence, creative problem solving and effective thinking and learning, but it also favours **cheating** and **free-riding** behaviours, even at the expense of the group as a whole.
- **group level** - selection between groups within a population.
    - Selection between groups within a population favours behaviours that increase the **fitness** of the **group** - **cooperation**, **cohesion**, **loyalty**, **bonding**, etc.

The survival of our ancestors depended on **both** I-think and Group-think. As a consequence we have evolved the ability to do both.

Human groups and societies have to **strike balances** between I-think and Group-think. Those balances can, should, and do shift as circumstances change. You could say that human groups compete, in part, on their ability to negotiate effective context-sensitive I-think : Group-think balances - harnessing the creativity of the individuals whilst maintaining the health of the group.

Moral Foundations Theory
researchers carried out cross-cultural studies of 'virtues' and came up with a **list** of the core evolved **moral emotions/sensitivities** that are common to all human groups. (see 'The Righteous Mind - Why good people are divided by politics and religion.' Jonathan Haidt) (also on TED talks).

Here is a quick summary of their list of **evolved moral emotions** and sensitivities;

care / harm, order / destruction,

- This sensitivity to signs of suffering, need and intra-group cruelty, evolved because of the challenge of caring for vulnerable children – caring for other group members – food sharing – protecting group resources.

fairness / proportionality / reciprocity,

- evolved to reward cooperation and reciprocal altruism - to detect and stigmatise/punish/correct cheating behaviours.

- Fairness ranges from the small picture childlike 'he got more than me' to the big picture of the Protestant Work Ethic and the Hindu Law of Karma.

- Co-operation and reciprocity are quickly withdrawn if cheating and freeloading are not stigmatised.

- Proportional rewards are respected and increase group bonding.

- Equality (as distinct from fairness/proportionality/reciprocity) does not appear to be one of our evolved moral emotions. It is more a political device, focusing on just one aspect of the whole moral matrix, to unite and divide groups (usually the have-less against the have-more). It was used to great effect by Genghis Khan, who temporarily united the warring Mongol tribes by promising and delivering; equal shares of booty (cooperatively plundered from their wealth creating neighbours) plus, meritocratic social mobility and death. But this resulted in a system which needed to keep warring and plundering, along an ever expanding boundary, in order to keep its social structures functioning. And that, like all pyramid/Ponzi schemes, was unsustainable.

in-group loyalty / subversion,

- is a sensitivity to signs that another is, or is not, likely to be a good team player - evolved to form and maintain coalitions. We trust and reward loyal people. We hurt ostracise even kill those who betray us or our group.

authority / respect,

- evolved to meet the adaptive challenge of forging relationships that will benefit us within social hierarchies.

- It is a sensitivity to signs of rank, deserved status and behaviours **appropriate** to a given position.

purity / sanctity / degradation,

- a **disgust** reaction, evolved initially, because of the adaptive challenge of the **omnivore dilemma** (its good to eat new things, but how do you know if it contains pathogens) – and then, in response to the broader challenge of living in a world of pathogens and parasites.

- This developed into a **behavioral immune system** – which can make us wary of a diverse array of **symbolic objects** and **threats**.

- We can invest these objects with irrational and extreme values - both positive and negative - and this plays an important role in binding groups together.

But this is a book about **systems thinking**, so let's introduce some fundamental systems concepts.

- I-think suffers from **simple perceptual distortions** and **deletions** which are easily made and easily corrected.

- Group-think is plagued by **self-reinforcing** perceptual distortions and deletions (group members influencing other group members' perception), which often results in **inflexible beliefs** and **ideologies** - them-and-us exaggerations – good guys and bad guys - halos and demons – vicious and virtuous circles and networks – cover-ups, and conflict escalation.

Neural Network Simulations
(my special interest) have shown us that our amazing evolved neural network structures are capable of an abundance of **information processing behaviours** that were **previously unimaginable** under the enlightenment's mechanistic and rational mind sets.

The primary neural ability is the **detection of associations** between two or more stimuli / events - happening **close together** in **time** and **space.**

This **association detection** ability enables us to;

- recognize stable objects and recurring situations in a changing world,

- perform very subtle groupings of objects and situations, which helps speed up our object and context recognition, and enables us to make rapid decisions despite limited and noisy data (an amazing achievement),

- trap both personal and shared-group experiences;

    - absorbing our group's culture – myths, meanings, values, blind spots, taboos,

    - building up a sense of what many **different contexts normally** look like,

    - using context to **frame, categorize** and **judge current situations,**

- fire-off rapid default emotional and moral reactions, and their associated behaviour packages (the fast system),

- and make up memorable impressive emotive stories (that appeal to other peoples' fast systems) to explain and justify the decision - and bind the group into coherent action.

- Sometimes - with sufficient experience, maturity or training, we **may**;

    - refer a problem up - to the newer parts of the brain, that slowly laboriously think about problems in a particularly human way (the slow system); rule-following, step-by-step, data searching, model building and evaluating, prediction testing (both confirmation and falsification) and statistical probability calculating,

- generate alternative perception and response packages,
- predict, compare, evaluate the comparative desirability of alternative possible / probable outcomes,
- consider risks and socio-cultural limitations,
- consciously select a course of action,
- explain the thinking to others.

Behavioural Economists
have been looking at how we make **economic choices** – and they too found that we are **nowhere near** as rational, as we used to like to think.

Neuroeconomists have been making great progress in studying the roles that different parts of the brain play in making those (irrational emotional) economic decisions.

It is popular at the moment to talk about human thinking having a **fast** system and a **slow** system. (see Daniel Khaneman)

The Fast System.
Most of our decisions are made very rapidly, on automatic pilot, by our experience-trapping neural networks, with no conscious awareness at the time the decision is made - although we are happy to invent diplomatic ways of justifying/rationalizing these decisions - after the event.

Decisions are made by **integrating**/comparing the strength of the **output** from a number of **separate sub-systems** - dealing with;

- body condition - priority needs (thirst, hunger, shelter etc.), endocrine arousal,
- emotions - like or dislike, towards or away from, attraction or disgust, risk, threat, danger,
- anticipated rewards,

- pre-existing cognitive models - which carry the neural equivalent of possibility, probability, consequence prediction - (cognitive models do affect the fast system),

- pre-existing socio-cultural norms - inhibiting and prescribing particular behaviours.

The fast system is **amazing** - it can make pretty good, **heuristic**, life and death decisions, even though it usually only has **noisy** and **inadequate data** to work with. It is very **emotional**. It is **not rational**.

The Slow System
is a very different type of thinking. This is where we deliberately remove ourselves from the overwhelming emotion of the situation and think **consciously** about costs and benefits, anticipated risks and rewards. We consider, and maybe even test, a variety of possible models of reality, each with their own possibilities, probabilities and consequences. Then we modify our conclusions and actions, to take account of cultural, social and diplomatic **norms** and **possibilities**.

- This type of thinking usually involves following evolved, and evolving, social **rules** that tell us to pay **attention** to particular **aspects** of particular **types** of problem (framing).

- These rules exist because we have learnt, as a group, from experience, that our brains don't always pay sufficient attention to all the relevant aspects of each type of problem.

- You can find these **rules** and **local thinking frameworks** all over the place, in every profession, field and discipline; the police service, the judiciary, in hospitals, on therapists' couches, in business consultants offices, architects offices, building sites, stock markets, science labs, design houses, manufacturing companies, etc.

Skewed Perception.
The fast system's perception is **skewed** in lots of ways - for example - the **current** moment can never be seen cleanly - it is always **perceived** and **interpreted** in the light of previous **personal experience** and **cultural framing**.

Loss and Gain, Certainty and Possibility.

We react differently to **gain** and **loss** - when we are in a 'gain' situation we become very **risk averse** - when we are in a 'loss' situation - we are prepared to do **very risky things** - in order to try to get out of the loss situation.

- Check out Butch Cassidy and the Sundance Kid - deciding what to do when they are cornered by the posse - "https://www.youtube.com/watch?v=1IbStIb9XXw "the fall will probably kill you!"

- It makes sense evolutionarily. Faced with a tiger - giving up and getting eaten means no more children - taking a risk and jumping into a ravine to try to escape **may** lead to more children.

- Taking risks to escape a loosing situation doesn't always produce a good outcome, but we are the descendants of those ancestors for whom it did produce a good outcome. Hence this bias in our thinking.

We react differently to **certainty** and **possibility**.

- **Certain** decisions are made almost instantaneously and involve **very little neural activity**.

- **Considering possibilities** involves a lot of **sustained neural activity** - which keeps our attention focused on the issue, and sends a more **powerful signal** to the decision **integration** process - which explains why our decision making is skewed **towards possibilities** and **away** from **certainties**.

    - Lottery example - buying a lottery ticket is almost certainly a loss, a small but definite risk, but the strength of that certain loss can't compete with the fascinating continuing possibility of winning an enormous amount of money. So we buy lottery tickets despite it being a highly irrational thing to do.

If you want a clear personal experience of this **loss** and **gain, certainty** and **possibility asymmetry** in action **-** log-on to one of the many Foreign Exchange trading platforms and open up a **dummy trading account.**

- Even when no real money is at stake you will find that your self-control and pre-prepared rational trading plans (I will get out it if goes against me by 6 points) go out of the window as soon as you find yourself in a loosing position.

- You start to make stupid and risky decisions (I will double up because it must come back my way soon and then I will be 'in the money') - driven by your hardwired compulsion to escape from (and not accept) the loosing situation. The possibility that the market might come back your way, and turn into a gain, outweighs the simple certainty that you are in a loss.

- If the trade does move back in your favour and you find yourself 'in the money' - most people react by becoming very risk averse, and opt to take a **small certain profit now** rather than hang on in hope of a larger profit later**.** The neural activity related to the possibility that it may turn into a loss again **exaggerates the risk, making a small but certain gain more attractive.** So traders spend a lot of time in loss situations and a small amount of time in profit situations. The sure way to make money in the foreign exchange markets is to be involved in providing the market place, the software, the training, **selling other people the possibility of gain.**

I do not recommend FX trading for amateurs. The neural odds are massively stacked against you.

The version of **systems thinking** presented in this book, grew out of all these endeavours.

Systems thinking has definitely increased our effectiveness in those areas where it has been applied. But there are still many other important and hugely influential areas of life, where it has not yet been applied, even though we would all benefit a lot from its introduction, because, whilst **everyday human thinking** can be **amazingly good,** it is also, often, **alarmingly flawed**.

Learning and applying the **systems thinking approach** helps us;

- understand and mitigate those flaws, and

- take full advantage of our evolved cognitive strengths.

There is nothing new or difficult, elitist or gender specific, about the core components of systems thinking, and yet, this potent, tried and tested **style** of thinking is still **not** embedded in any **school** or **university** or **business** or **political** or **religious curriculum** (except perhaps the Vedic inspired traditions), is not yet widely understood by the general public, and is not being publicly demonstrated or promoted by our media or our elected politicians – although they both, of course, use it extensively in their own private strategic and operational thinking.

Teaching Ourselves.
So – we will have to **teach ourselves**, which fortunately, will **not be very difficult** because **all** the **core activities** of systems thinking are things that we **naturally** do, **every day**, already.

Identifying separate **things,** objects;

- noticing their **unique,** their **essential** and their **optional** properties,
- noticing their **similarities** and **differences,**
- noticing their **life-cycles** of **possibility** and **probability**,
- **grouping things** into appropriate/useful **classes/categories -** very important.

Noticing apparent **relationships** between things;

- **local** (close-coupled in time and space) (easy and automatic), and
- **long-range** (problematic, prone to untested invention and superstition).

Noticing (imagining, imposing) **recurring patterns** of (apparent) **cause** and **effect.**

- Human groups are bound together by their shared acceptance of stories – fact and fiction are easily blurred in the process. Invented causes can easily come to be believed as established group-facts.

Noticing processes and setting process goals - inventing algorithms for controlling and filtering flows and stores, and chasing goals.

- Sequence, conditional selection, and iteration until a goal is reached, are common elements of our algorithmic thinking.

Noticing **system dynamics** – extremely important;

- emergent properties,
- emergent behaviour patterns,
    - independence – dependence,
    - simple growth or decline,
    - limits to growth or decline,
    - self-reinforcing growth or decline, exponential, geometric, e.g. compound interest. This can apply to quantities of things, or to ideas and beliefs.
- information feedback and control loops,
- interactions between multiple (perhaps competing or non-aligned) feedback and control loops – giving rise to complexity.

Being aware of boundaries and contexts;

- **local perceptual distortions**; assumptions, ideologies, beliefs, frameworks, filters, blind spots, taboos,
- **local forces** of **attraction** and **repulsion,**
    - the range properties of those forces,
    - and the vicious and virtuous, circles and networks that spontaneously grow up around these forces,

- local limitations, regulations, requirements, prohibitions,
- local exemptions, protected areas, trump cards (rights, privileges),
- cross boundary **flows of**;
    - resources,
    - information,
    - control and influence,
    - environmental feedback.

Winding the handle;

- exploring the variety of possible circumstances created by the rules of the game,
- considering how other people are perceiving and modelling situations;
    - what alternatives and constraints are they perceiving?
    - what goals are they chasing?
- considering consequences - **predicting** what will happen next - **if this or that - then**.

Making decisions;

- who decides – individual accountability and joint responsibility,
- when are decisions made,
- considering the whole picture - alternatives and options,
- setting and chasing appropriate goals,

- prioritizing goals,
- considering **alternative routes** to our chosen **goals,**
- selecting **preferred routes** and **methods,**
- designing goal-chasing algorithms, using feedback and control loops. If Then Else Endif, Do While Enddo, Case statements,

Building **individual** commitment and **group-level** commitment to a shared plan;

- vector alignment -
- getting everyone and everything (resources, forces, attractions, incentives, self-reinforcing self-interested networks) all pulling in the same direction,
- shared frameworks,
- shared beliefs,
- shared stories to bond around.

Learning - reviewing and updating;

- our **neural** (experiential) (fast) **models - and**
- our **theoretical** (group shared) (slow) **models,**
  - (the **fast** and the **slow systems** can hold incompatible models)
- our assumptions, predictions and decisions (both fast and slow),
- in the light of ordinary experience, and the outcomes of specific model-based interventions.
- Designing experiments to test our models.

- Rare but very important.

We can **all** do **all** these **core activities** – but **often** we **don't.**

We **can** do them **very well** - but **sometimes** we do them **very badly**.

We get better at all of these components **if** we **practice**.

Usually – we do **some bits well** and **other bits badly**.

Group Learning.

- Individual thinking is pretty well adapted for learning from personal experience.

- Group-think has self-reinforcing dynamics which can make it very difficult for groups to learn from experience.

So, hopefully you agree, that we should strive to improve our systems thinking and learning skills;

- as individuals,

- as groups of individuals, and

- as groups of groups.

Cover-ups and Denials
are common **group-think** phenomena (**self-reinforcing** perceptual distortions and deletions). We should set the church bells ringing, to alert the whole community, whenever a cover-up is **detected**, because cover-ups **prevent learning and separate the group from reality**.

- Working **out-of-step** with **reality** is hard work, confusing, frustrating, unproductive, and a waste of time. In the end – after many time-delay-induced oscillations - **reality wins.**

How to Develop Systems Thinking Skills and Intuition?
Systems thinking development begins with;

- realising the importance of **doing all these bits well,**

- establishing the **habit / discipline**, of **paying attention** to **all the core components and activities**,

- developing a **shared vocabulary** so that we can **communicate** systems thinking **observations** and **concepts with each other**,

- establishing a **culture that supports the reviewing, testing and updating of models,**

- particularly when our **models don't match reality**, when our **interventions** produce **unexpected results** (desirable or undesirable).

Core Systems Components.
So by way of introduction – here is a list of the **core system components** we need to **learn to recognize**. Don't be alarmed if some of these distinctions don't mean much to you yet. Curiosity is an appropriate state of mind at this stage.

Structural components;

- things, objects, classes of similar things – and their properties,

- relations between things – and their properties,

- flows and stores - control of, trigger levels, limits, filters,

- feedback loops - design loops, maintenance loops, information and control loops,

    - decision cycles – accountability and responsibility,

    - lean or sloppy loops – accuracy, timing,

    - algorithms - sequence, selection, iteration until...,

    - evolution – generate variety, selection, replication,

- interacting feedback and control loops – how this gives rise to complexity,

Dynamic patterns;

- emergent behaviours – archetypal patterns and properties,
- independence, dependence,
- simple growth - simple addition,
- self-reinforcing growth – ratio addition, positive and negative feedback,
- goals – deliberate purpose or emergent attributed purpose,
- goal chasing and balancing,
- limits – simple or self-reinforcing, trigger levels, stepped ratios, release valves and overflows,
- forces – attraction, repulsion, range,
- vicious and virtuous circles and networks,
- measuring the changing state of the system;
    - variables, dimensions, parameters,
    - the whole - patterns, component archetypes,
    - deterministic / probabilistic modelling.

Boundary - properties;

- open and closed systems,
    - control, influence, observe only,
    - prediction - the uncontrollable and the imprecise, can still be understood and predicted to some extent.

- System DNA.
    - DNA used here as a metaphor to mean the local dominant ideas and organising principles that **control** the system's **continuous self replication** - assumptions, ideologies, beliefs, symbols, rituals, perceptual distortions,
    - designing and evolving the DNA,
    - maintaining the DNA,
    - stopping replication of the DNA.
- Change vs. Transformation.

    Change is just a change of behaviour within the existing cycle of **possibility** and **probability** established by the system's DNA.

    Transformation is a change to the system's DNA – the establishment of a **new** cycle of possibility and probability.

Environment;

- control, influence, prediction,
- external feedback,
- shared resources;
    - renewable or finite,
    - simple or self-reinforcing depletion,
    - various expressions of the 'tragedy of the commons'.

So as you can see – there is **nothing magic** or **difficult** there – just basic, everyday, human-graspable stuff.

SO WHY DO WE DO IT SO BADLY, SO OFTEN?

The suite of 'thinking' abilities available to the modern human brain, developed over something like 50 million years of mammalian evolution.

We **all** come from a very long and **unbroken** line of **survivors** (yes - it is hard to believe sometimes).

Survival requires a lot of skilful **compromising** and constant context-sensitive **juggling** of priorities; water, food, avoid danger, understand and map resources and threats, store physical and cognitive resources, build functional cooperative groups, reproduce, etc.

Attention Control
is a key **evolved ability** in enabling all this priority juggling - controlling what to pay **attention** to NOW and what to **ignore** NOW.

- Most attention control is pre-conscious, **automatic,** (the **fast** system).

- Only rarely and briefly do we engage in conscious **deliberate attention control** (the **slow** system).

So there are good evolutionary 'explanations' for why our everyday 'thinking' shows up as a **compromised** package of **strengths** and **weaknesses;**

- why we pay **attention** to some things and **ignore** others,

- why sometimes we **learn** from experience but other times we stick rigidly to **established assumptions** and **beliefs**, and stop questioning and learning, despite ample evidence that our **current model** of reality is clearly **flawed**;

    - does not accurately describe and predict reality,

- and is directing us to chase;

    - inappropriate goals,

    - in ways that actually cause more 'fixogenic' problems.

So I repeat - **systems thinking** is primarily a matter of;

- training yourself to pay attention to each of these core structural and dynamic components,
- realizing the importance of doing ALL of them well,
- and then doing them ALL well.

So - get in the **habit** of **asking** those **simple questions** that will **focus your attention** on checking how well you are observing – **paying attention to**;

- **things** (their separation and grouping),
- **their relationships,** interconnections, interactions,
- **contexts** and **boundaries, local perceptual distortions,**
- **emergent behaviour patterns,**
- and remember to;
- **step outside** (the perceptual distortions of) **your usual** (normal) **frame of reference, occasionally,** and ask **how the situation appears, from other points of view.**

For this is where high quality **understanding, decision making** and **learning** are to be found. Time spent on this style of thinking is **always time well spent.**

Time spent **chasing** the **wrong goals** and making **interventions** in a **system that you don't properly understand** is very likely to be **counter productive.**

It is not an exaggeration to say that **all** the major **problems** facing humanity involve the **emergent properties** of **interacting systems.**

> (global finance systems, global economic and trading systems, global climate and geological systems, global resource distribution and exploitation (pipeline wars), human culture and religious

systems, human individual and group level competition - all interacting)

Intervening in systems which you don't fully understand, almost always produces unintended consequences which are often, but not always, undesirable.

Happy accidents do occur quite often, by chance, but we should **not** make the **mistake** of **pretending** that these lucky outcomes were the result of our **understanding** or **skilful thinking.**

Old Think and New Think.

- **Logic** - categorical thinking,

  classification based deductive thinking, for example – **all** Xs are Y, this **is** an X, so it **must** be Y,

- plus simplistic isolated reductive causal thinking,

  studying things by **reducing** them to their component parts, and **isolating** very small groups of components to **simplify** the investigation of cause and effect,

- very effectively dethroned superstition,

  a way of **explaining** remote causations, based on a **belief** in an imagined web of interconnections that did **not require** any **demonstrable,** physical, cause and effect, linkages,

- and thus - categorical logic (deductive thinking) and isolating reductive causal thinking (supported by probability and statistics), became **western culture's preferred thinking style** for the last several hundred years.

Many of the words we commonly use to talk about thinking come from that logical and reductive tradition.

More recently it has become clear (again) that the **universe is hugely interconnected** and can only be **properly understood** via a **holistic**

approach which looks at the **connectedness,** and the **emergent properties** and **behaviours,** of **whole systems** (think climate modelling).

- Logic and isolated-simple-cause-thinking have their uses, but they cannot deal with complex interconnectedness.

Systems Thinking is a Holistic Approach.
It uses traditional logic and reductive thinking where **appropriate** (to correctly identify and describe **things** and their **relationships**) - but we must **never** lose sight of the **interconnectedness** and the **emergent properties** of the **whole.**

Chapter 2

Things and Groups of Things

Our brain has **evolved** to **perceive** the **world** as a **collection of things -**

- individual things, objects, and
- groups of things = categories = classes = entities = types.

It makes sense to **group things together** into classes /categories - **IF** they are **usefully similar;**

- in their **nature,**
- in their **behaviour,**
- in the **given context**,

because - **IF** we **know** and **understand** a **thing's type –** then we know **what** to **expect** - in terms of its;

- **essential** properties,
- **optional** properties,
- **behavioural** repertoire and triggers,
- and the **possibilities** and **probabilities** of its **life-cycle.**

So when you encounter a group / category / class that;

- someone else has composed, or
- your **culture** is presenting as a **default category** (probably via the media),
- ask -

- What are this category's membership criteria?
- What are the essential and optional properties a thing should have, in order to be considered a member of this grouping?

Things have properties = attributes, features.

There are 4 important sorts of properties;

- **unique identifiers –** ways to identify a specific member of a group,
- **essential properties**,
- **optional properties**,
- **recurring properties** – lists, histories, e.g., previous addresses.

Properties have **names** and **values.**

The values may be restricted;

- one only – as in a birthday,
- select **one** from a limited check list – animal **or** vegetable **or** mineral,
- select **any** from a limited check list,
- free within possible range limits – as in age,
  - (may be a smooth or lumpy continuum),
- multiple current values,
  - e.g., people may have more than one current email address, vehicle, job,
- multiple historical values.

Things have life cycles – cycles of probability and possibility,

- an acorn may grow into an oak tree – but not into a willow tree.

Things can have a **repertoire** of many **behaviours** (called methods in computer speak);

- behaviours affecting themselves,
- behaviours involving or affecting other things,
- behaviours can be context sensitive, triggered by particular circumstances,
- behaviours can change / evolve over time,
    - history of previous behaviours,
    - current behavioural repertoire (possibilities),
    - common habits (probabilities).

The **quality** of our **categorical groupings** is very important but sadly nebulous – because our culture does **not yet have commonly understood words** to describe the **quality of our categories**. We need to **invent** some catchy **category-quality describing words** - to help us reflect on, and assess, the quality of our categories.

There are two basic quality issues –

(1) the **membership criteria** and the resulting **degree of similarity,**

and

(2) are the **criteria commonly understood?**

1) The Basis of Group Membership – and the degree of similarity it produces.

ASK yourself - is this group's membership based on;

- **an appropriately large number of essential attributes** (e.g., a traded commodity, a particular model of washing machine), or,

- a **misleadingly small number of optional attributes** (e.g., supporters of a particular football team)?

    - Knowing it's a Bosch Exxcel 1400 is the **key** to finding out **everything** you are likely to need to know about a particular washing machine.

    - Knowing that someone is an Exeter City supporter tells you **nothing** about their; occupation, accommodation, education, nationality.

    - Knowing that an animal is a Hereford cow **probably** tells you a lot about it.

    - Knowing the weight and quality of a gold bar, in troy ounces and carats, **certainly** tells you all you need to know about it.

So – to repeat – ask yourself - is this category's group-membership based on **all essential properties** or just a **few optional properties? It's a sliding scale.**

The Equality Dimension
the second aspect of the **membership quality** issue - can be highlighted by asking - are **all** members of the group **equally good members of the group** – or do they **vary** = are there **good** and **bad examples** of this category?

- The types of group/sets we use in **logical** thinking usually **assume** that **all** members of the set are **equally good** members of the set (prime numbers, all men are animals).

- But the kind of categories that our neural networks create can be **much more subtle** than that. For example, we all intuitively know that robins and ducks are members of the bird class, but cross-cultural studies have shown that we consider robins to be **better** birds than ducks – ducks swim under water, can eat under water – they are quite fishy in some ways, and they don't sing, they quack. Ducks are birds, but **robins are better birds than ducks.**

- The classes, Robins, and Ducks, are both; more **consistent,** more **similar,** more **specific,** than the more **general class,** Birds.

That is why **general classes** are **prone** to having **more** and **less representative** members – which could/should probably be grouped into more specific sub-classes – **if it is useful to do so.**

We use a lot of these **general** classes - but we hardly ever stop to ask if John is a **good** or **bad example** of a - Racist / Fascist / Socialist / Banker / Refugee.

This is a huge weakness in our human thinking.

We are capable of making much much much finer distinctions.

Practise challenging **over-general categories,** and making **fine distinctions** - where you can, if it is safe to do so, if it matters.

Encourage other people to question whether X is a **good**, or a **bad**, or a **perfect**, or an **imperfect** example, of Yness?

Sometimes we enshrine **over-general categories** in law. Particularly laws which seek to implement **universal principles** or **rights.**

We seem to feel that we should not make **subtle distinctions** or set any **limits** on things we have defined as '**universals**'.

But what if it was a **mistake** to call them universal - what if the **reality** is that 'universals' get a bit fuzzy and **relative** and **complex** and **contradictory** near the edges - when you look at the whole dynamic interconnected big picture.

- So, for example, we have laws preventing **discrimination** on the grounds of **religion** - but **religion**, and **discrimination** are both **hugely general categories.**

- What if a **new** religion required, or allowed, or encouraged its followers to do things which were **already illegal** in that society? The anti-discrimination law would allow **religion** to be used as a **trump card** for breaking those pre-existing secular laws.

- Surely it would be more **coherent** to use more **specific categories,** and define what **types** of **discrimination** are, and are not, allowed, in relation to **specific**, illegal but religion-justified **behaviours** and **beliefs**, and in which **specific contexts** these secular behavioural **requirements** and **exemptions** apply.

- We have done something similar with the over-general concept of **asylum**, creating a highly desirable **trump card** which appears to override all other valid national entry requirements. This trump card is so desirable and valuable that an international network/industry has sprung up to share in that trump card's unique value. The asylum definition could easily be **adjusted in the light of experience,** so as to better achieve the **original humanitarian** intention, whilst reducing its exceptional trump card value.

- There is an **asymmetry** built into the system, in that the people smugglers (individuals and networks) are inter-nationally **distributed** and **beyond** the **legal reach** of the destination countries that bear the costs and responsibilities of providing asylum. Surely the conventions and legislation (the DNA) that created this system should be adjusted in the light of experience to address this asymmetry, and to **balance** the powerful and international **temptation** to **abuse** this **very special privilege,** with a matching set of very special and **internationally effective punishments** for all those participating in the **deliberate abuse** of this privilege.

2) Is It Universally Understood?

The second **Category Quality Issue.** Is the class/category's meaning universally understood? Are the **membership criteria**, and the **degree** of **similarity**, commonly **understood** by the **'stakeholders'?** Usually not!

- A good category tells you a lot about each of its members – **a bad category appears to - but doesn't.**

- It's all about the **precision** with which you can **reasonably infer knowledge** about a thing, **based** on its suggested membership of a suggested category/class. How much of its identity is **dependent on, determined by, can be inferred from,** its **suggested class membership - and** to what extent is its identity **independent** of the **suggested class membership.**

- So - in order for classification/categorisation to be a **useful communication and thinking tool** it is necessary for **all** the parties to the communication to have a **common understanding** of how the class has been constructed – (the **extent** and the **proportion** of the **essential** and **optional membership criteria**).

Usually we don't have that shared understanding.

Sometimes the lack of clarity is **accidental**, but often it is **deliberate** – because the powerful **emotional impact** of positive or negative **association** (in the fast system) is immediately **broken** if we **engage the slow system** and **start trying to precisely define** the essential and optional properties required to be considered a proper x, y, z.

- Look at the daily news – it is littered with poor quality, undefined, un-agreed categories, being used to **trigger emotional associations.** Our media continue to do this, because we continue to **accept these emotional associations without question or complaint.**

- If we **challenged** the **quality** of the **media's presented categories** – then their attempted emotional hijackings and cognitive manipulations would be exposed for what they are, and the perpetrators would be discredited.

The fundamental reasons for **evaluating** and **challenging** the **quality** of presented **categories,** are

- the pursuit of truth, and

- respect for reality.

There are also many reasons why we **don't** challenge bad categorisation - why human groups have taboos, fudge issues, and ignore elephants in the room. These **reality distorting strategies** are rooted in the **evolutionary advantage** enjoyed by coherent, vector-aligned groups, over diverse-vector (but truth directed) groups.

So if you are interested in the **pursuit** of **truth** and **respect** for **reality**, you should be asking;

1) **Quality** - where does this proposed category's membership criteria sit on the **sliding scale - all essential properties** to **one optional property?**

2) **Consistency** - are all members **equally good members of the group?** Are the members **identical** or **consistently similar – or is there a significant degree of variety?**

3) **Context -** what membership **criteria/properties** do we need to be concerned with **in this specific context?** Can we **accept** the **default classifications** or do we need to **redo** our things-groupings - for this **specific context.**

4) **Agreement** - are the **membership criteria** and **degree of similarity clearly understood** by **all** the '**stakeholders**'? If not, there will be complex misunderstanding and confusion.

So - **categories vary in quality.** They also **evolve -** they **adapt** to **changing circumstances** and **contexts.**

When expressed in **language,** they are inevitably **less subtle** than the categories represented in our neural networks – **because** our **personal** neural networks can make **finer,** more **numerous** and more **subtle distinctions** than our **shared vocabulary** can **describe.**

My politics is far more subtle than left or right.

My judgements about people are based on a huge number of subtle distinctions, not just on skin colour, country or culture of birth.

Good and Bad Categories.
In the **best** categories - all members are **functionally identical** and there is **total clarity,** understood by **all concerned,** as to the membership criteria.

- Examples – traded commodities – a troy ounce of 22 carat gold, a barrel of Brent Crude oil.

- What shall we call them? – hard categories, precise categories, complete categories, perfect categories, valid categories.

- Consider. Discuss. If you come up with something catchy – spread the word.

In **useful everyday** categories – the members are not identical, but are consistently similar in all important ways, in relation to the relevant context, and the membership criteria are commonly understood by all concerned.

In **over-generalised** categories – the **real world distinctions** and **similarities** are much more **subtle** than our **simplistic** general **naming** system can convey – and **thus**, members are **not all equally good members** of the group. Birds; robins and ducks share many essential attributes, but some aspects of their lifestyles are quite different – but in daily life it is, on balance, an aid to communication.

- If you are standing on a river harbour wall and point in a particular direction at a scene including a duck and a boat, and say, "Look at that **bird**," people will focus on the **duck** and not on the **boat**. (Of course – boat is another very general category.)

- What shall we call these over-generalised, simplistic, quick but vague, do for now but no good for detailed thinking, categories?

Public relations and propaganda agents often use **emotional-association** categories – designed to invoke emotions of; like or dislike, good or bad – triggered by a suggested link or association with an existing, simplistically named, good or bad, category, whose membership criteria are either; not specified at all, or not in sufficient detail, and therefore, are not commonly accurately understood.

- This car is sexy. UKIPers are racists. Tories are selfish. Public sector workers are good and need **your** money to help meet the 'needs' of the 'vulnerable'. Pointing out flaws in NHS performance shows a lack of respect for this great institution which suggests your real intention is to destroy it.....

- We could call these **deliberate** (or **accidental), emotionally manipulative propaganda categories**. Can you think of a name that encapsulates these key aspects in a snappy phrase? Consider. Discuss.

Grouping things on the basis of **one optional attribute** is a really bad use of categorisation. For example; people who happen to support a particular football team. This is like **making** up a **group name** for the things that just **happen** to be in a **junk shop** or a scrap yard.

- The fact that they are **in the junk shop**, is all they definitely have in common.

- The only thing that Exeter City supporters definitely have in common – is that we call them Exeter City supporters.

- We could call these 'junk shop,' or 'scrap yard,' or '**name only**' categories – because there is **just a name, based on a single criteria** with no attempt at any further membership criteria definition.

- Of course, if the **context** is, deciding which entrance to use at the football stadium, then it is a very appropriate classification. But if you are being encouraged to like or dislike someone because there are a 'lefty' or a UKIPer, or a 'banker', or a 'public sector worker', etc., then that is **very shoddy thinking**.

Learn to recognise these **'name only'** categories – question whether or not they **carry** any **useful meaning** or **reliably imply** any other (dependent) **attributes**. Challenge them where it is **necessary** and **safe** to do so.

Today - a national radio station, which to its credit, dedicates each hour to hearing callers' views on a particular topical issue, asked whether 'immigration' had been a good or a bad thing, and whether 'public sector cuts' were a good or a bad thing.

- 'Immigration' and 'public sector cuts' are both **hugely-general name-only** categories that are crying out for **finer distinctions** to be made. But there is an enormous social psychological cognitive power in the **public over-general framing** of these **questions** because the issues have been politicised - turned into **group-think signifiers**. Not one of the callers suggested making **finer distinctions**. All accepted the **'either good** or **bad'** framing.

- The category 'immigration' includes millions of **unique** individuals and **all** the **consequences** that have followed from their **migration** and **cultural dislocation**, for **everyone** affected.

- It is a **bonkers category**, crying out for **more subtle distinctions**. And yet we fall for this **simplistic emotional triggering** - over and over again.

- 'Public sector cuts' - well **cutting down on**; waste, inefficiency, poorly defined counter productive goals and perverse incentives, breaking-up fraudulent self-serving vicious circles and networks that siphon off money that should have been used to benefit the public, exposing and punishing corruption and conspiracies to cover-up failure and abuse - **all sound good to me**, but not perhaps to those who benefit from, or are trapped in, such activities. But education (knowledge and thinking), skills training, re-training, health promotion, health care, proportional policing and genuine resource-pooling risk-sharing safety nets, all sound like good things that should not be cut. So to my mind it is another **bonkers category**, crying out for **more subtle distinctions**.

- Opinion polls often ask questions about hugely general junk shop categories - "Do you feel the Government is doing a good job?"

Look out for **bonkers**, **emotive**, **group-think-signifying** categories crying out for **more subtle distinctions**.

One or Some equals ALL.
Perhaps the most serious **mistake** we make when using **categories**, and one that we make over and over again, even though we know better, is making **careless** and **flawed assumptions** as to what you can reasonably infer from membership of **generalised** categories.

- When thing X has **one,** or **some,** of the **many essential and optional** attributes of class Y – we somehow **assume** that X has **all** of the **essential** attributes of class Y – **wrong, wrong, wrong.**

This is a huge impediment to human debate and group **cognitive evolution** – so I will say it again – because of its associative nature, **the human brain is very easily tricked** into **wrongly assuming** / **concluding** that

because X has one attribute, that is one of the many optional or essential attributes of class Y - it is therefore a full-blown highly representative member of class Y.

This one=some=all trait, is an inevitable consequence of the way our neural networks detect associations. Detecting associations has been a huge benefit;

- it is an essential element of our amazing perception and meaning-making abilities, detecting objects, recognising patterns, forming rapid assessments of complex situations despite noisy and inadequate data,

- and it embodies the precautionary principle - assuming that glimpse of colour could be a tiger.

But this trait has a down side. It can, and frequently does, trigger some very rapid jumping to some very wrong but highly believable assumptions.

If you think about it for a day or so, you will notice that we make very rapid decisions about people and situations, which are not logically justified by the available information. In a few seconds our senses notice flags, triggers, signifiers, that fire off (by neural association) large packages of assumptions - popularly called stereotypes -

- these cognitive leaps can be triggered by; appearance, posture, body language, vocabulary, accent, grammar, idioms, dress sense, hair style, body modifications, employment history, tomato sauce on chips, preferred drink; beer or lager, G & T, wine or spritzer, hot chocolate or coffee - choice of car; off-road adapted 4 by 4, 2 door jaguar, eco dual-fuel-hybrid - types or reading material, newspapers, favourite TV programs, leisure activities; football supporter, rugby supporter, show jumping fan, golf enthusiast, cinema, opera, theatre, religion and sect, political allegiance, type of school, quality of university, choice of subject specialisation, level of education, type of qualifications.

The impact of this down-side (the logical one=some=all flaw in this otherwise very valuable thinking ability) can become greatly exaggerated if it gets entangled with group-think and group-membership dynamics -

particularly if there is what might be called a **group orthodoxy** involved - which is very common;

- approaches to education, reasons for education, causes of climate change, nature vs. nurture, what constitutes social progress; subsidize or empower, protection or evolution, borrow or earn.

Powerful forces (reward and punishment) encourage group members to **adjust** their view of the world to **fit in** with the **group's orthodoxy.** This strengthens group boundaries, filters group membership, and aligns group vectors, but this group dynamic is **no respecter** of **truth** or **reality.** It **distorts** our **perception** of **reality.** It is **not** a **truth-directed process.**

Emotive Propaganda.
This kind of logical error (One=Some=All) can easily happen **accidentally,** but often, it is a **deliberate** act of **emotional propaganda,** an **emotional hijack,** an **emotional racquet (look at me – I am good – you are bad,** or worse still, look at **us, we** are good - **you** are bad**)** - in which case it usually comes hand-in-hand with an aversion to defining precisely what they mean by Y - an aversion to defining Y's essential and optional attributes - because the perpetrators know, intuitively, that **if we engage our slow thinking system, it will break the power of the emotional association.**

We could call this **an emotional hijack by trivial association.**

- It is an **emotional name calling** exercise (left wing, right wing, separatists, freedom fighter, terrorist, insurgent, pro-R-rebels, moderates, extremists), with no attempt to clearly **identify** and **agree** the category's membership criteria in terms of its **essential** and **optional attributes** and **behaviours.**

- It is an attempt to stop any **deeper analysis** or more **nuanced thinking** - and it often works.

- It is a racquet. It says, "For good people, like us, this simplistic association is all the thinking you need to do, in order to like or dislike this thing, person, idea."

When the selection criteria that define a particular category are **not generally understood and agreed** – then references to that category will

probably **get in the way** of **cooperative, collaborative, constructive** thinking.

It will be a major issue, and a major cause of **confusion** in any attempt at **cross cultural, cross system, cross boundary cooperative modelling of a situation.**

Recognising **accidentally flawed** and **deliberately manipulative categories** in commercial and political propaganda is an important skill to develop, and a major component of effective systems thinking – because **flawed categories drag you away from reality.**

Finding a **constructive** way of reacting to deliberately flawed and manipulative categories is the holy grail of **diplomacy.** Putin's and Lavrov's patient considered responses, to the West's recent campaign of manipulative emotive categorical propaganda against 'Moscow' (a city?), has been a master class of dignified cognitive self-control, that we may be able to learn from one day - but not yet.

Finally – **detecting** and **grouping things**, is a core neural network ability.

The human brain is capable of, and usually is, operating **very subtle distinctions** - much more subtle than either the available vocabulary, or the slow-system's logic, can describe.

The down-side is that it makes us **prone** to **association errors**, which can be exaggerated by the dynamics of **group orthodoxy**.

I-think usually has more **subtle** and more easily **up-datable categories** than **group-think.** Consider. Discuss.

Chapter 3

Things have Relationships with other things.

Relationship = connection between things or groups of things = interaction = affects or is affected by = gets involved with = considers the state of.

Relationships have some important properties - they can be;

- optional or compulsory,
- uni-directional or bi-directional,
- one-to-one (I am driving one car),
- one-to-many (I own more than one car),
- many-to-many (each teacher teaches many students, and, each student is taught by many teachers),
- reflexive = relating back to itself, affecting itself, self-referencing, self-reinforcing,
    - as in compound interest or geometric growth,
- causal – but is it;
    - the whole cause – the only cause of – a 'necessary and sufficient cause',
    - a partial / contributory cause – one of many causes,
    - a conditional cause – in certain circumstances,
    - an imagined cause;
        - a simple error - we imagined it was a cause when it wasn't,

- we spotted an **association,** which was in fact a **random coincidence,** and wrongly **assumed** that one **caused** the other,

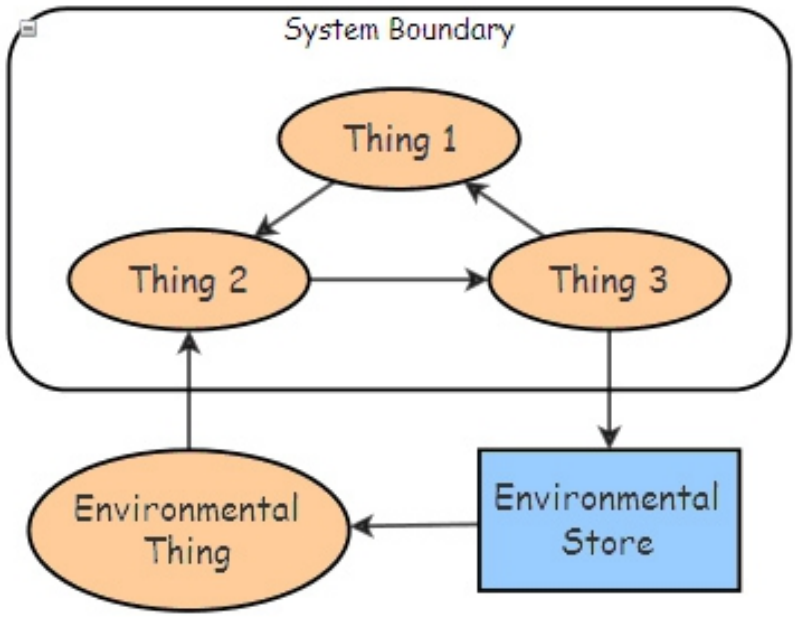
- we spotted an **association** and **assumed** one caused the other when in fact they were **both** the result = an effect of, some other as yet **unidentified cause**.

Relationships can;

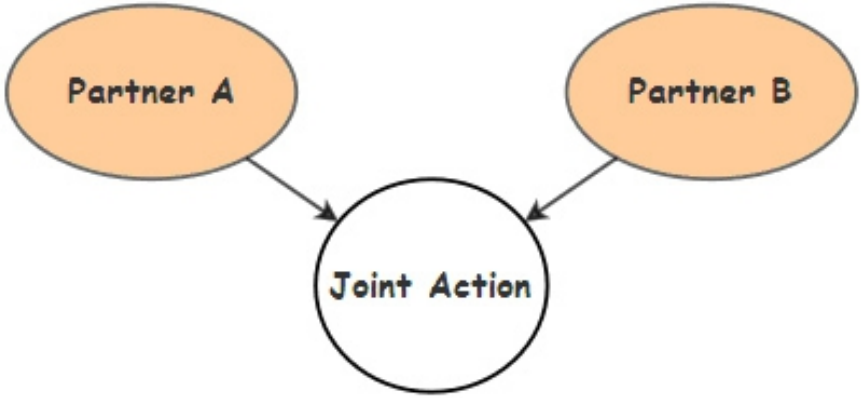
- be aware of, consider, read, any property value in the whole system - if they are connected by an information feedback loop,

- change property values - **if** there is a **causal/dependent** relationship.

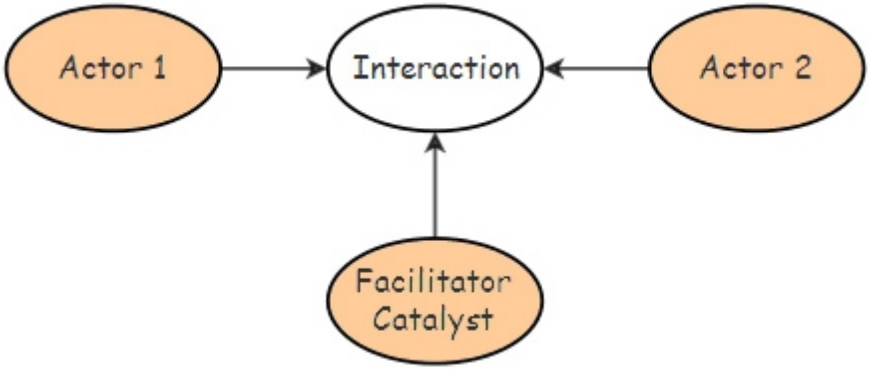
Groups of Relationships.
A group of relationships can form a **feedback loop.** These feedback loops may be contained within the system boundary, or they may operate via the environment.



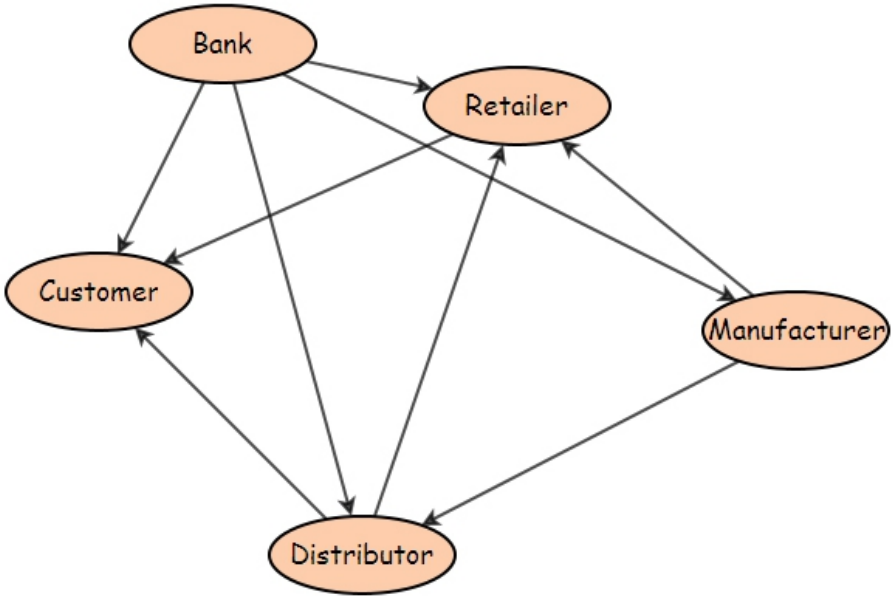
Groups of relationships can also form a partnership structure – where two or more partners are involved in, or responsible for, some joint action.



Groups of relationships can also form a facilitator or catalyst structure, where the facilitator enables, or changes the nature of, the interaction between others. This is similar to the structures seen in control switching or amplification circuits – where a small but crucial input – acts like a key – switching on or off a complex or powerful process.



Groups of relationships can also form **network** relationships - groupings of agents, connected into a self-reinforcing self-perpetuating network. This is a very common, and a very powerful organising principle.



Every time you buy something from a shop, or an online retailer, you are benefiting from a **network** of **cooperating agents** - manufacturers, distributors, retailers, banks, etc. These networks are held together by the participating agents' **mutual self-interest** in the **perpetuation** of that **network.**

Networks **evolve**, particularly if circumstance or technology changes.

Networks are **dynamic** - each agent would like to be a **monopoly** and would like all the other agents to be weakened by **competition.**

Sometimes networks collapse. Sometimes new networks spring into being.

- With a bit of imagination, communication, and cooperation, a simple competitive environment can develop into a self-reinforcing network, based on subtle variations of "you scratch my back and I'll scratch yours." In the old days the scratching was probably deliberate and face-to-face, but in these digital days, it can be remote, indirect, virtual, unplanned, spontaneous, viral.

Networks can offer fantastic benefits to humanity. They can also be highly exploitative and dangerous. That is why we have laws against anti-competitive, price-fixing, cartels and monopolies, etc.

Two hot topics at the moment are the **self-interest networks** that have grown up to **support** and **exploit**; the mass migration of 'refugees', and the networks involved in the mess of violence in Syria.

- The mass migration issue is an example of a **distributed** self-interest network, spontaneously self-organised around a **central attractor** - the possibility of **profit** from exploiting the high distributed **trump-card value** created by the **current** definition of asylum, whilst bearing **no responsibility** for the long-term **costs** of providing asylum, and the absence of any internationally effective system of **punishments** for **abusing/exploiting** (as opposed to **supporting**) refugee migration.

- Some network members **simply** profit from the local situation -

    - selling tents, dinghies, life jackets - selling or hiring out redundant fishing boats (rendered uneconomic by EU fishing quotas).

- Some members form themselves into more complex **self-reinforcing network relationships** -

    - both-sides-winning lawyers advising people-smugglers, directly or via the news media, in order to drum-up and direct legal business toward a particular destination country,

    - the media, presenting the story in a variety of emotive ways to increase domestic sales of newspapers, but also, spreading the word internationally, fuelling the temptation and drumming up business for all concerned,

    - looking-good ideologues,

    - fund-chasing charities,

    - vote-chasing politicians,

    - cheap (non-unionised non-complaining / illegal) labour exploiters,

- public sector Ponzi scheme managers, etc.

That is a lot of different agents, all benefiting in their own special way from the continuation of a flawed asylum definition.

The definition of asylum could easily be **rethought** in ways that protected and enhanced the original **humanitarian** intention, reduced the **excessive** trump card value, and **punished abuses** wherever they occur. That would cause the **network bubble** to collapse, as quickly as it grew. It would of course be hard to **agree** a way of distinguishing between **support** and **abuse**.

The situation in Syria appears, on the surface, to be an example of an assortment of many **different attractors** / forces / incentives, causing many different agents (161 different identifiable groups in the news today) to participate in a chaotic situation, for many different reasons.

But maybe this is also an important example of how a situation can **appear** incomprehensibly **complex** - but then - with the discovery of a **key** or root **eureka** component - the **complexity dissolves** into a simple (but still not necessarily true) explanation.

- One such eureka component **could be** the realisation that there are two **competing** pipeline proposals to get gas from a huge new gas field in the Persian Gulf, to European markets. A North route and a South route. Both pipelines **need** to pass through Syria.

- The South route would be traded in US$ and is backed by (benefits) USA, Saudi Arabia, Quatar and Turkey - the North route would not necessarily be traded in US$ and is backed by Russia, Iran and Syria/Assad.

- This discovery could coherently explain why these groupings have formed, and why they have been fighting or funding proxy fighters, as they do seem to have been doing.

- The many different proxy fighters may have their own reasons for fighting, and for accepting the funding and support. Their reasons will probably have evolved as the situation developed, and may

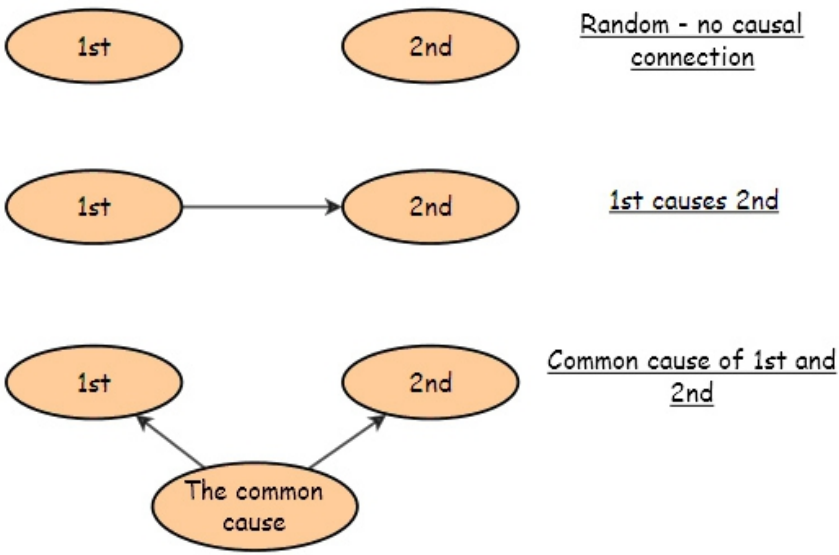
now bear little relationship to the initial issue - which pipe line gets built?

- This **superficially coherent** competing pipelines **model** suggests that what is holding this **network** in place is the huge **potential value** created by these **either or**, winner takes all, pipeline options, being exploited in many different ways, by many different players, in exchange for **cash/value now**, and or support in the pursuit of their own **local** (tribal religious) **goals**.

    - **N.B.** I don't know if the above is true, or a root cause, or not. I am not part of that particular **information feedback loop**. I just give it as an example of how **identifying** fundamental **root causes**, can **transform** apparent **chaos** into something **understandable** - in a way that - focussing on multiple **symptoms** and **peripheral issues** - usually does not.

    - Models based on fundamental causes are **closer** to **reality**, make **better predictions** of **what-ifs**, lead to better **decisions**, and are a better starting point for **future learning**.

Things to Consider about Relationships.
I repeat - Consider the direction of causation;



- is it cause – is it affect – are both the result of something else,

- or is the apparent association just a random coincidence?

Consider **independence** and **dependence.**

- If you are thinking about **groups of things** (= classes = categories) – consider which **properties** of the 'thing in question' are **determined by (dependent** on) its group membership – and which aren't (which are **independent** of its group membership)?

    - In the context of a phone book - if you know my name and address, you can look up my phone number, but not my age. My age changes all the time but my phone number and address only change occasionally.

- If you are thinking about **relationships** – consider which **properties** of a thing can be **changed** by a relationship with another thing **(dependent)** and which can't **(independent).**

    - The **depreciation** (£value = a property) on my car (a thing) will **depend on** how **I** (a thing) **look after it** (relationship)**.**

    - The **make** and **model** of my car (properties) are **not dependent** on how I look after it.

    - You **can** lead a horse to water but you **can't** make it drink.

Dependence and **independence** are very important concepts in the study of **statistics** and **probability**. Pay attention. Get very familiar with this **distinction** - it is incredibly useful in all sorts of problem solving.

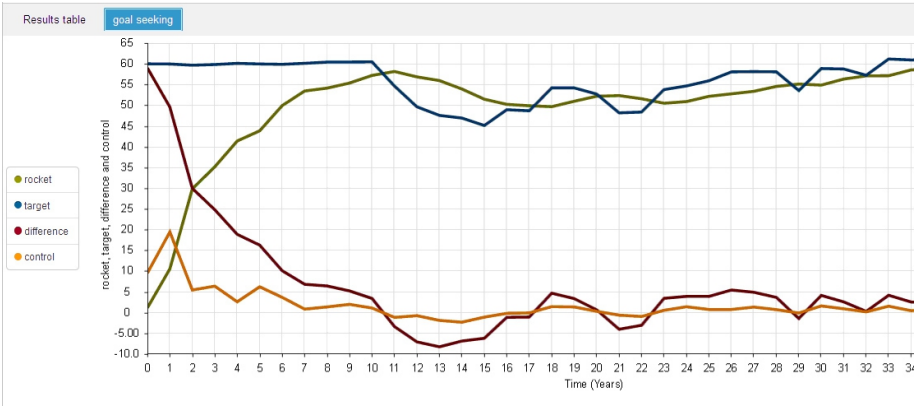
Consider **time** and **space.** Is the **association** / **causation**;

- **close-coupled** or **remote** (unexplained, missing links, imagined, superstitious),

- **direct** (one link) or **chained** (multiple links - including via the environment),

- **timely - time delays** in feedback or control loops cause **oscillations.**

- Below is a simulation (using Insightmaker.com) of a fairly typical goal chasing behaviour. In this particular case, we are pretending it is a rocket chasing a target. Every 10 time slots (a delay), the rocket works out the difference between its position and the target's position and adjusts its position to move closer to the target. The target makes random adjustments to its direction when it detects a rocket near by. Even if the target wasn't making random movements, the rocket would never actually hit the target, because it is moving towards where the target was 10 time slots ago, not where it is now.



- The trajectory lines for the rocket and the target do cross - giving the appearance that the rocket hit the target, but actually they are never in the same space at the same time.

- Time delays (or inaccuracies) in information feedback loops, decision cycles, or action control loops - cause oscillations. Overshoots and undershoots. Very, very common.

Consider - **open** or **closed** systems.

In **closed** systems – the **internal** relationships **control** everything that happens - there are **no other influences**.

- This is actually an **ideal** notion which is very rare in reality.

Open systems are affected by influences (**external** or **internal**) that are not completely under the system's control.

Internal examples of a loss of control typically stem from;

- a **lack** of **precision** in – information flow or control-action specification,
- **time delays** in information and control feedback loops (slow or periodic decision making), and
- **random variations** in **reality** where the model **assumed simplistic uniformity** (remember the degree of similarity between individual members of a category).

External influences can be completely out of your control (meteorite strikes, solar storms, earth quakes), or they may be, to some extent, the result of the system's effect on the environment.

- External influences may not be controllable – but they may still be **predictable**. Solar storms definitely will happen – and their strength and frequency seem to follow an 11 year cycle (approx). Earthquakes and tsunamis will continue to occur in certain geologically active areas.

Relationships can often be **described** by;

- fixed ratios,
- stepped ratios - gear boxes, income tax rates,
- algorithms – sequence, selection, iteration until, particularly in processes,
- formulae, calculations;
    - a common one is – calculate the difference between **reality** and the **goal** = comparison with a goal; used in the control of flows and stores, to maintain steady states or chase goals.

Relationships give rise to;

- causation - control - influence - independence or dependence.

Where **relationships** are **grouped together** into **information** and **control** feedback **loops, emergent behaviours** can arise, particularly;

- goal chasing, or maintaining a steady state,
- simple or re-enforcing growth or decline, and
- limits to growth.
- processes - recurring patterns,
    - control of flows and stores,
    - entity life-cycle changes,
    - creation or assembly of new entities,
    - changing the nature of entities, probability and possibility,
    - destruction of entities.
- **forces** - that tend to push the system towards or away from particular states, or structures;
    - attractions, repulsions, with range properties,
        - long range, short range, how does strength vary with distance, etc.,
    - vicious and virtuous circles and networks, perverse incentives,
        - pushing the system in a particular direction, but not necessarily in response to formal explicit goals - may be just **emergent forces at work.**

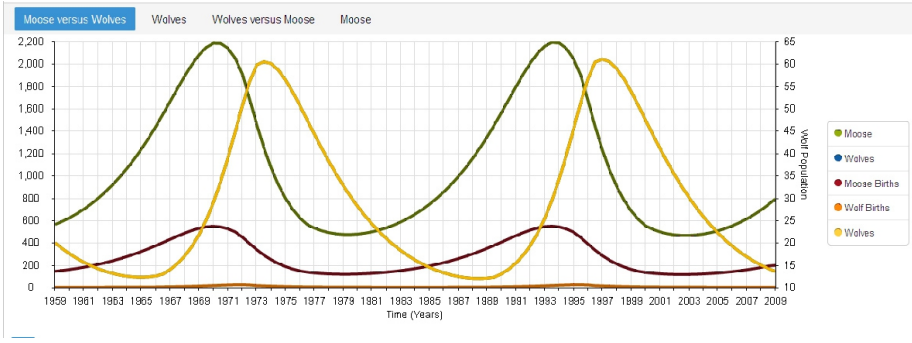
Consider the **quality** of information and control loops,

- Are they **lean** or **sloppy**?
    - Sloppy loops cause delay oscillations and inaccuracy oscillations.

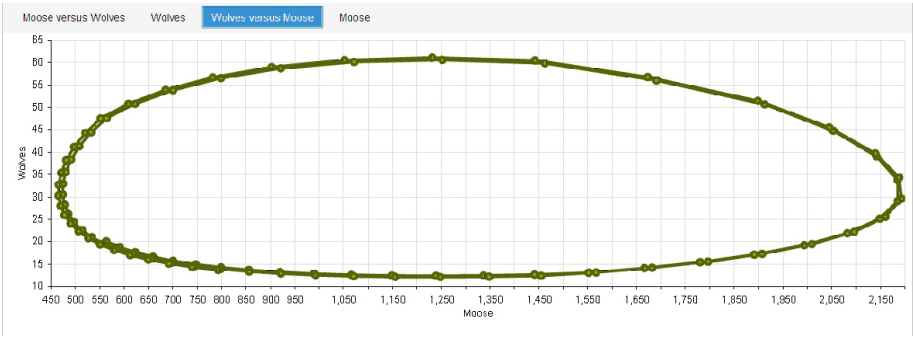
Is there interaction between different loops?

- Dependent **loop** interactions can also cause delay and inaccuracy oscillations, giving rise to;
    - **simple** cycles, recurrent phase planes (see below), or
    - **complex**, **chaotic patterns**.

This plot (below) shows the interaction between moose and wolf population levels. Notice that the wolf population takes about ten years to respond to rising moose numbers at the bottom of the cycle and only 4 years to respond to falling moose numbers at the top of the cycle. Wolves need a sustained abundance of food to mature and reproduce, but can die from a single episode of insufficient food.



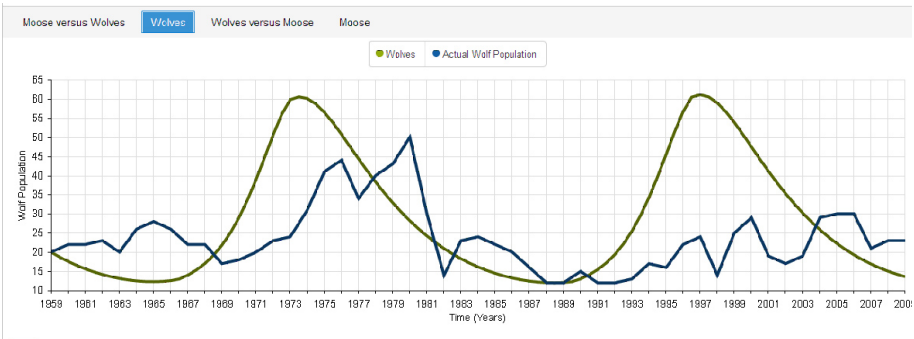
This is the same information shown as a phase plane.

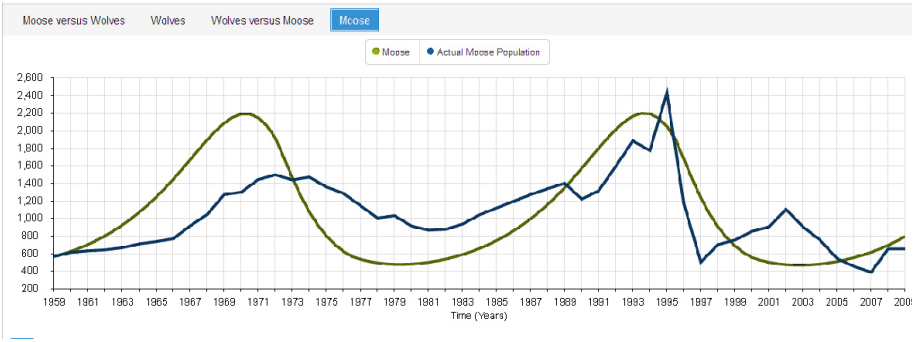


The Map is Not the Territory.

The model is **not** a **perfect** reflection of reality.

The smooth curves below are produced by a simplified mathematical model, the jerky lines are real data collected about the moose and wolf population levels.

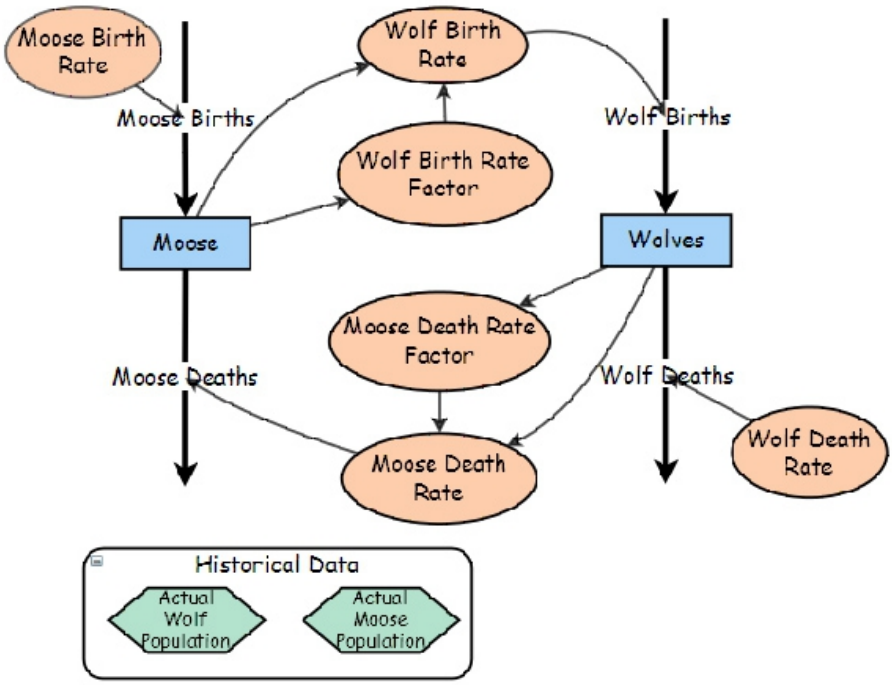




Below is the top level entity relationship description of the wolf/moose system model, used to create these simulation plots (from the Insightmaker web site). The ratios, numbers and algorithms describing the

relationships are at the next level down - accessed by clicking on the appropriate blob or box.

Go to the web site and have a go yourself.



None of this dynamism could happen without **relationships between things**.

It is time to introduce two background concepts;

Black Boxes and **Evolution.**

The black box approach. It is easier to see the whole picture, the whole system, if you are not overwhelmed by too much low level detail – so we summarise the complexity inside processes and reduce it down to a black box with just three components;

- inputs,
- a change function - which takes place inside the black box; the details of which we need not be concerned about, for now, and
- outputs.

If you really **need to know** how the inputs are changed into the outputs, you look inside the black box (moose death rate, for example). As long as no detail or subtle distinctions are lost in the process, this summation / simplification device works well.

A black box can contain small and simple, or huge and complex transformations. A car manufacturing plant can, if it is useful, be represented as a single black box with lots of;

- **Inputs** - orders for cars, contracts, patent licence agreements, ready made components, raw materials to be made into components, paints, tools, energy, hardware, software, people arriving for work, knowledge, skills, cash, grants (to attract investors to the area), credits, debts, etc.
- **Change functions** – many and evolving,
- **Outputs** – people leaving work, new cars of various specifications, waste materials, patent license payments, contracts, heat, cash, credits, debts, taxes.

Evolution. There are three steps to any evolution process;

- generate variety,

- evaluate / select from that variety,
- replicate.

Processes.
Lets look at a simple process in an everyday example of a **nearly closed system**, consisting of;

- you,
- a bath,
- a mixer tap,
- a plug hole, and
- an overflow outlet.

When you turn the tap on, water flows into the bath and out of the plug hole. Notice how we all assumed an unlimited supply of clean filtered water. If the **flow in**, is **less** than the maximum **flow out** through the plug hole, then the water level in the bath will not rise. If you increase the flow in through the tap, to a level greater than the maximum flow out through the plug hole, the water level in the bath will rise. If the water level gets up to the level of the overflow pipe, water will leave the system via both the plug hole and the overflow. If the flow of water coming into the system is still greater than the combined flow of water exiting the system, then the water level will continue to rise until it flows out over the edge of the bath. Simple.

- But the flow of water passing out of the plug hole may be affected by the water level in the bath; higher water level means higher pressure at the plug hole, which usually means greater flow out of the plug hole. The water flowing out of the overflow will certainly be affected by the water level. As the water level reaches the lip of the circular overflow, the initial flow out will be just a dribble. If it rises 10 mm higher, the flow out will increase a lot.

- Also - some water will be evaporating. Hot water will evaporate more than cold water. Hot water will cause the bath to expand a little – increasing its volume. Hot water cools down. Etc.

- A more comprehensive model will embody a more accurate description of reality than a simplistic superficial model.

If you want to fill the bath to a particular level, you put the plug in and turn on the tap. When the level is where you want it – you turn the tap off. The **information feedback** and **control** happens in your mind and body. The **purpose,** the **intention,** is in your mind.

- The water cistern attached to your toilet is similar in many ways to the bath example, but it introduces a new feature, a **mechanism** to fill the cistern to a predetermined level (a goal) after the toilet has been flushed, or, we might say, that it has a **purpose** - to keep the cistern full so that the toilet is ready to be flushed.

- We often attribute purposes to inanimate processes whose behaviour is totally controlled by their design and the laws of physics.

- A toilet cistern clearly has no awareness, choice or intention. There is a float on a lever. The float rises as the water level rises. The lever is connected to a valve, which at a certain point, stops water flowing into the cistern. The point at which the flow is stopped can be adjusted. If water evaporates or leaks, the water level drops to a point where the valve allows a little more water into the cistern. The water level is maintained – within limits. Those limits are presumably affected by changes in atmospheric pressure and the phase of the moon – but we don't bother about it.

- The mechanism in the cistern is the way it is, because of **design evolution.** The purpose, the intention, was in the minds of a series of designers who did what evolution always does – they created a variety of options, evaluated and selected one that worked, and then made lots of copies of it. The goals in their minds were to keep enough water in the cistern to flush the toilet when required, and to make and sell the cistern at a profit.

- The water level at which the inflow is stopped (the goal) can be adjusted, if necessary, within limits, by human intervention (guided by intention and purpose). Between adjustments, the system uses a **mechanical feedback** and **control** mechanism – as opposed to the **information based feedback** and **control** mechanism **you** use to control the water level in your bath.

A lot of people use toilet cisterns perfectly effectively without knowing how they work. That white ceramic or plastic box is a black box as far as they are concerned.

I think you will agree that all these fundamental systems concepts are well within our normal cognitive grasp.

Now lets use the bath example to illustrate;

- simple growth,
- compound (self-referencing, self-reinforcing) growth,
- limits to growth, and
- delay and inaccuracy oscillations.

Simple Growth.
If the tap is dripping and the rate of the dripping is **not related to (is independent of) the amount of water already in the bath**, then the increase in the volume of water in the bath is an example of **simple** growth. Even if the rate of dripping varies, it is still simple growth.

Compound Growth.
If the rate of inflow **is related** / proportional to (dependent on) the volume of water **already** in the bath – then that is **compound** growth. For example, if you were in a small **shallow** bath and the water was going cold, and you wanted to raise the temperature a few degrees, you would probably turn the hot tap on a **little** bit – to make sure you don't seriously overshoot your desired temperature, and to give it time to mix evenly. If you were in a **deep** bath and you wanted to raise the temperature a few degrees, you would probably turn the hot tap on **quite a lot more** – because **you know** that you need to add **more** hot water to raise the temperature of a **large**

volume of bath water, than of a small volume of bath water - and there is less chance of local overheating in a larger volume of water, as long as you keep your feet away and stir the water enough.

If you had a very deep/large bath you would have to add **ever greater** flows of hot water to keep a constant temperature in the bath - demonstrating compound growth in; the flow of hot water in, the heat loss out, and the volume of water in the bath.

Limits to Growth.

If the bath (an ordinary bath) was nearly full, nearly at the overflow level, and you turned the hot tap on, the water may reach the overflow level before it reaches the desired temperature. If that happens, then a lot of the new hot water will go straight out of the overflow. We have all been there. So - you have to let some water out of the plug hole – (wasting some of the hot water you just added) to make enough room for enough new hot water. It is much better to let some water out first, because then, you need less hot water to raise the temperature to the desired level. But usually we don't. We don't like the feeling of loss, as the water level drops, exposing warm wet skin to colder air. We have evolved to avoid losses if we can.

So - there is a lot you can learn at bath time.

Sometimes I wonder if our politicians and managers have ever been in a bath. If you see them making **basic, unsustainable, flow and store management, target setting, or goal chasing errors**, you might like to recommend they take a bath.

On a serious note – it is safe to assume that **all growth**, be it simple or compound, will **encounter limits** at some point. (The bath will overflow if you leave the plug in and the tap dripping.)

- Look around for limits to growth waiting to happen.
- Are they under your control or influence?
- Can you predict when they will kick in?

It is pretty obvious in the case of the bath. It is harder to predict at what point your business's expansion will result in such a reduction in the quality of your customer service that your customers will start to desert

you (simple loss) - and maybe take their friends with them (self-reinforcing network-based loss).

Goal Setting.

In the bath context, most of us 'just know' what water temperature we like. But I suspect most of us often find, when we first get in, that we have made the water slightly too hot. We probably knew it was a bit too hot, but we forced ourselves in, slowly. Inaccuracy. But we quickly acclimatise, and the water starts to cool down. In no time it feels as if it would be nice if it was a bit hotter. How many of us measure the temperature when it is just right, and use that measurement as a guide when initially filling the bath? I wonder if the queen has her bath run at a defined temperature?

Pay attention to your goals;

- what goals you **do** set,
- what goals you **could** set, but don't.

Can you improve your goal setting?

Delays and Oscillation.

If you plotted a bath-times graph, showing water temperature, water level and satisfaction rating, against time, I guarantee it would look something like this.

- The **temperature** usually starts slightly too high because of inaccuracy and sloppy goal setting, falls gradually until you decide it is too cold (heat loss and acclimatisation), then rises rapidly (as you add more hot water), then falls slowly until it is uncomfortable, then rises a bit more slowly, then, at some point, you have to let some water out of the plug hole, and then the temperature rises fast again, etc. The proportion of elapse time during which you would say that the temperature was within the ideal range, is maybe 35%.
- These **oscillations are caused by delays and inaccuracies in the feedback and control system.**

This is a universal **systems-truth.**

- Delays or inaccuracy in perception or measurement,
- delays or inaccuracy in information flow,
- delays or inaccuracies in decision cycles,
- delays or inaccuracy in implementing control actions,
- delays or inaccuracy in the system's responses to your control actions,
- all produce oscillations.

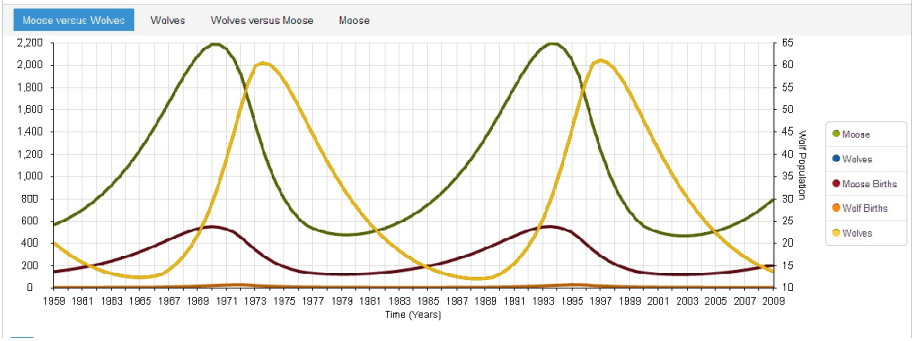
Oscillations are **everywhere**, and yet we habitually set **static** goals and targets.

- Setting a static goal for the water temperature makes good sense. Setting a static goal for the flow at the tap would be a **nonsense,** as it needs to change **depending** on the situation. Setting a static goal for the water level is a reasonable idea – but - if you want both - constant level and constant temperature, it is going to be very difficult to achieve if you are just using a tap and a plug to control the process.
- You would be better off perhaps with a thermostatically controlled heater element, safely out of the way in a separate but connected chamber, and a circulation pump.
- There – a new invention. An example of how systems thinking can produce new insights and creative solutions.

Dependent Loops.
Where **two or more oscillating systems** are **dependent on each other** (water **temperature** control and water **level** control), you will find complex behaviours.

A classic example is the 'predator : prey : food supply' relationship (seen above).

One year there is plenty of food for the moose herd, moose numbers rise, so wolves do well as well, and after a delay, the wolf population rises, but by now there is a (relative) food shortage and the moose population crashes (not enough food and too many wolves), then the wolf population crashes (not enough moose for too many wolves), and the cycle starts gain.



The recent crash in the price of oil is an example of **feedback** and **control delays** and **inaccuracies,** in **dependent systems**. The oil price was high enough to make investment in fracking viable, so many companies began investing in fracking, but it takes 6 months and millions of dollars of investment before the fracked oil actually starts to flow. Then there was a sudden huge increase in the supply of oil as the new fracking wells all come online together, so the price crashes, to a level at which many new and some long established oil production technologies are no longer viable and production falls – so the price rises again. Bingo, oscillations.

So we have looked at;

- things,
- the grouping of things,
- relationships between things,
- flows, filters and stores,
- foundation emergent behaviour patterns;
    - simple growth,

- compound growth,
- limits to growth,
- delay and inaccuracy oscillations,
- dependent loops oscillations.

The System Boundary.

In a massively interconnected universe, it makes sense, for practical purposes, to draw a boundary around any system of interest, to limit the scope, to focus attention - **whilst recognising its interactions with its environment**. The system boundary is a way of identifying what is inside the system – and distinguishing it from what is outside the system.

- Consider a living animal, located in its normal environment. Inside the animal is a very special place – very different from outside. So the animal's skin looks like a good place for a system boundary. But if the animal is a social animal, which can only survive as a member of a group, it might make sense, in some situations, to expand the boundary to include the whole group.

In **open** systems, the boundary is not a complete barrier. In the case of an animal - lots of things cross the boundary, air, food, water, light, sound waves, bacteria, viruses, heat energy, sweat, scent, smells, waste products, etc.

The **traditional**, systems theory based approach to defining system boundaries is to **analyse** the situation in terms of **control** and **influence**.

- **Inside** the boundary are the elements that are under the **control** of the system.
- **Outside** the boundary are elements that **may affect the system** but;
  - are only **partially controlled** by the system = elements over which the system has **some influence,**

- and elements over which the system has **no control or influence** – but which it can still reasonably attempt to **observe** and **predict.**

This **control/influence/observe** distinction is a powerful and useful idea - a good framework for analysing situations.

It makes very good sense, in all areas of life, to try to **expand** and **improve** your **control** and **influence** over;

- things that can affect you,
- things that you think you need or want (western culture),
- and
- to try to reduce your attachment to, and **dependency** on, things that you **can't control** or **influence** (eastern culture?).

So I recommend a system thinking addition to the serenity prayer.

> God, grant me the serenity to accept the things I cannot change,
>
> The courage to change the things I can,
>
> And the wisdom to know the difference.
>
> Plus -
>
> If you can't control or influence, then **observe** and **predict,** in **proportion** to the potential **opportunity** or **threat.**

So, **control – influence – observe and predict**, is an **ideal** basis for defining a system's boundary. However, in **reality**, human organisations tend not to follow this guidance.

We define **operational boundaries** (departments, divisions) that don't perfectly match the ideal control / influence / observe and predict boundaries.

- Human Resources manage recruitment and training for the Education Department. Finance manages procurement for everyone. Teachers can't get course books because of Finance's cost-saving diktats, or photocopies because of Property Services' obstructive incompetence. Marketing sells more course places than there are classrooms or teachers or materials to support. Standards fall, word spreads (network), student numbers collapse - then (after a period of denial = a delay and an inaccuracy) management reacts. Bingo, oscillations.

- The system boundary between hospitals and social care is a current hot topic in the UK, although the problem has been known about and discussed for 20 years. One major obstacle to solving the problem is that hospital staff and local authority staff have different pension schemes, different pay structures, different management, different financial arrangements, which leads to turf wars – sub-systems protecting themselves rather than serving the customer. The current **core organising principles** of the two systems are very different.

- Geographical, geopolitical, trade agreements, are about to become a hot topic as the UK considers alternatives to full EU membership and the BRICs begin setting up an alternative system of international trade and development finance (alternative to the IMF and World Bank). The **core organising principles** of these two systems may be very different.

System DNA.

Here is another **useful approach** you can use when thinking about system boundaries.

- First – get your head around the idea that systems are **constantly re-creating** themselves according to their **DNA.** Every action, every reaction, is a passive decision to continue implementing the current normal DNA of the system.

- Whilst the DNA stays the same, the possibilities and probabilities of the system's behaviour stay the same. Only when the DNA changes, can the system's behaviour change.

The system's DNA includes all the 'normal' assumptions and perceptual distortions - filters and spot lights, ideas, visions, values, goals, structures, agreements, contracts, rules, procedures, regulations, sensitivities, measurements, analysis, models, understanding - that direct the system at each moment of its **replication.**

- Most operational decisions are decisions about **how to implement the normal DNA**. They may produce some local change, but the outcomes will be within the normal cycles of possibility and probability established by the DNA.

- **Decisions** involving **changes** to the system's **DNA** are on a **completely different level**. These decisions **change** the **nature** of the system – **transform** the system. A little work at this level can have a huge effect at the lower operational levels. I suggest this is the systems concept behind the Taoist principle of 'wu wei' - effortless action.

The system boundary/DNA defines the **local normal** – and normal can be difficult to detect, especially from the inside. So get in the habit of looking at **what is special about each system's local implementation of normal.**

I repeat - what are the **'normal' assumptions and perceptual distortions - filters and spot lights, ideas, visions, values, goals, structures, agreements, contracts, procedures, rules and regulations (internal and external), sensitivities, measurements, analysis, models, understanding -** that direct the system at each moment of its **replication?**

Outside the system boundary is the **environment**, which has its own metaphorical **DNA.**

- The laws of physics, the laws of the land (environment, health, safety, fire and building regulations, company law, contract law, employment law, etc.), accepted commercial arrangements and structures, manufacturing methods and costs, design evolution and traditions, professional guild constraints, international energy and commodity supply dynamics, transport infrastructure, international trade agreements, international conflicts, sanctions, etc.

Understand these internal and external DNA structures. Would you trust your life to a driver who didn't understand what the car's controls do, or had no knowledge of the highway code?

Chapter 4

Winding the Handle - Emergent Behaviours

So far as we know, the **physical universe** can be modelled by the Laws of Physics (although our understanding of them is as yet incomplete). The current model describes a handful of fundamental **particles** and a few **forces** that control the **interactions** between those fundamental particles.

These laws are actually very simple and could probably be written on a sheet of A4, but they give rise to a **huge diversity** of **emergent behaviours** and situations - including everything in the universe, past, present and future. Pretty amazing.

'Winding the handle' is a mechanical metaphor for – working through, exploring, the emergent behaviours that can arise from;

- simple structures,
- made of things - in this case, fundamental particles, and
- their relationships - forces.

Chess is another **type of universe** - a game, with a set of **rules** governing the **behaviour** of a handful of types of pieces, played out in a defined space. It is pretty simple. Winding the handle means – exploring the system's emergent behaviours – exploring every possible combination of moves, every situation, every game that could possibly be played, within the rules of chess.

Emergent Behaviours.
So - simple **rules** governing a **simple structure** of interacting components can give rise to a variety of situations, a variety of **emergent behaviours**.

If you are **changing the rules,** or the **structure,** of a system, it **will** change the emergent behaviour of that system – so, when change is being considered, it is very important to 'wind the handle', to **think through** how those **changes** will **affect** the **emergent behaviour** of the **system**.

It is difficult to do this perfectly or completely – but there is **no excuse** for not trying.

Possibilities and Probabilities.
In chess – many of the games that could **possibly be played** never actually get played, because they are not interesting. They are **possible,** but not **probable.**

This is a common feature of emergent behaviours – they tend to settle down into a small number of **common patterns.**

Our brain **mistakes familiarity** with **common patterns,** for **understanding**, and starts to think that these **common** patterns are the **only possible** patterns - and then we get surprised when some small change kicks the whole system into a **different** pattern of behaviour – with a **new set** of **common patterns**.

So a **small change** can cause a **different set** of **possible** behaviours to become the **probable** behaviours (wu wei).

These behaviour changes can be hard to predict, but **IF** you are thinking of tinkering with complex open systems, particularly human systems, then it is a very good idea to do some handle winding.

So - **train yourself** to pay **attention** to the way **systems** give rise to **emergent behaviours**. Daily life is full of interesting examples.

- A manual gearbox in a car is a fixed structure of simple components (cogs on splined shafts). Moving the gear stick changes the relationships between the cogs, and produces a limited number of different input to output ratios. The driver gets to choose between those different input output ratios for different driving situations.

- Changes to income tax ratios may lead to changes in the common patterns of emergent behaviour in employers and employees.

- Employees may decide to work more, or less, or not more than X. These might be called primary effects. But those emergent behaviours may then trigger changes in **other systems** – secondary effects.

- Employees may decide to move to a different country with a different tax regime. Employers may decide to; create more or less, high skill or low skill jobs, invest more or less in training, invest more or less in robots and high technology processes, relocate to other countries with different tax systems, or other regions offering attractive grants and tax breaks.

- That emergent behaviour may trigger other emergent behaviours, with tertiary effects on; house prices, local economic activity, community and infrastructure planning, non-income tax revenues, etc., etc.

These emergent behaviours can also give rise to **self-reinforcing feedback loops** – incentivizing the creation of **vicious or virtuous circles.**

- Skilled educated workers migrate to attractive areas – thus depriving their country of origin of their skilled labour. The country of origin finds that it has invested in the education and training of workers who have now moved to spend the most productive period of their lives in already thriving countries.

- Maybe the country of origin cuts back on investment in education and training as a result, and maybe the thriving country cuts back on education and training **too**, because, for now, it can get the benefits for free (in the short term) from migrants. A **tragedy** of an **interrelated common.**

- Maybe it is low skilled workers that are on the move, and the recipient country starts to cut back on investment in new highly productive machinery and techniques because of the tempting availability of a surplus of cheap low-skilled labour.

- These feedback loops tend to have **delayed effects**, which as we have already seen, lead to oscillations, to problems becoming **severe** before they are **recognised** or **addressed,** followed by an **over reaction** – which sets off another chain of emergent behaviours.

- Benefit systems define who can claim which benefits and who can't, who pays for the system, and who gets paid to administer the

system. This encourages **common patterns of behaviour** in claimants and administrators, tax payers, voters and politicians, and can give rise to **self-reinforcing feedback loops** –

  - claimants and administrators tending to vote for politicians who will perpetuate or even extend the system,

  - excluded potential claimants might vote for politicians who promise to include them, or move to other areas where they will be included,

  - tax payers, who are neither claimants nor administrators, vote for politicians who promise to break that vicious circle and push the system back in the other direction, replacing benefit dependency with mechanisms to; enable and encourage self-sufficiency, and restrict benefit migration.

- The media cash in with emotive narratives to help bond each of the different groups.

- The system oscillates through a series of suboptimal situations.

- The **design** of the **electoral system** will have a major influence on the way these feedback loops operate.

Vicious (self-interested) and virtuous (group-health) **networks emerge spontaneously** - networks of agents focussed on, and linked together by **common self-interest or group-health protection**.

- Mass migration - human rights lawyers (both for and against), immigration experts (both for and against), civil servants, house builders, traditional landlords, social landlords, buy to let / B & B / short-term leasing landlords, urban regeneration consultants, employers, vote hungry politicians, newspaper sellers, welfare state managers, fence manufacturers, CCTV watchers, bubble surfing house owners, mortgage lenders, charity workers, employment agencies, people traffickers, language teachers, educational institutions, etc., etc., all have a different but shared vested interest in promoting mass migration, and perpetuating a flawed

asymmetrical trump-card definition of asylum, and the rules preventing deportation and exile.

- In time, after a delay, those with no personal vested interest, and other things to do, but who have come to perceive mass immigration as a serious net or specific **burden** on the **health** of the **group** as a **whole,** will start linking together to call for a rethinking of the concepts of open-door migration, asylum, citizenship, voting rights, etc.

- Bingo - suboptimal oscillations, denials and cover-ups, delayed recognition and reaction, over-shoots. Had a bath lately?

- Flooding - self-interest networks benefiting on a daily basis from; agricultural incentives with known but ignored consequences of causing rapid rain run off, profits from farming or building on flood planes, civil engineering interests benefiting from a failure to **work with nature**, rectifying controllable causes - resulting in a need to spend huge amounts of money **controlling nature**. Local and central government should be **balancing** these **competing interests** and **prioritising the general good** - but in some places this has clearly failed. The self-interest networks are busy every day - causing the problems. The general-good networks have other priorities most of the time and only get active when there is a crisis, when it is too late.

- Food - (sugar, salt, and fat) - self-interest networks are profiting from the strength of our individual evolved **desire** for sugar, salt and fat, but they have no responsibility for the long-term health costs for the individuals and the whole group. The self-interest networks that are causing the problem are busy all day, everyday. Where is the group-health-protection network? Where is the balance?

- How well **balanced** are the **self-interest networks**, and the **group-protection networks** active on the issues around; drug research and medicines production, misuse of antibiotics, the NHS, education, private/public transport, drug addiction and rehabilitation, the mechanisms causing some housing estates to fail, etc.

Self-interest networks and **whole-group-health and protection networks** have very different **life-cycles, emergent properties** and **behaviours.**

- The **self**-interest networks are busy, active, evolving, growing - highly motivated in pursuit of their high priority interest.

- The **group**-health-interest networks tend to have a slow burn, led by a few pioneers, but lacking mass support because, although most people do care about these group health issues, they have other priorities in daily life. It is only when a problem becomes acute that the group-health-networks get really active.

- By that time there may be so many interlinked self-interest agents benefiting from the **continuation of the problem** that it is **democratically impossible to stop the trajectory**. This is a system with the potential for periodic catastrophic failures.

- The smart thing to do would be to design a system that was better able to **balance self-interests** with **group-health**, and could **detect** and **nip** these **oscillations** in the **bud** - before they pass the **point** of **no return** - whilst fostering creativity and evolution.

- When these periodic group-health crises do occur, the smart thing to do is to **learn from** the **situation** and **rectify** the **flaws** (and any other similar flaws) in the **system's DNA**. At that point in the process, **amnesties** might be a better way of **getting to the truth** than **threats** and **punishments.**

Archetypal Patterns.
These chains of interlinked emergent behaviours can appear daunting – but at their core, are the same primary **archetypal patterns** we have already met. **Practice recognising them**;

- **independence**, **dependence** - in thing-grouping-properties and relationships,

- **cause** and **effect** -

    - association - apparent sequences in time and space,

    - causation - real or imagined,
        - only cause or one of many causes?
        - necessary and sufficient cause?
        - joint symptoms of a different cause?
        - coincidence - no causal connection?

- control or influence, observe and predict,
- information and control feedback loops - +ve & -ve impact, delays, accuracy,
- which enable;
    - simple growth or decline - simple addition or subtraction,
    - self-reinforcing growth or decline – ratio addition or subtraction,
    - gap computation,
    - goal chasing and balancing (maintaining a steady state),
    - group-think, self-reinforcing perceptual distortions,
    - vicious and virtuous circles,
    - vicious and virtuous self-interest and group-interest networks - a collection of agents linked by diverse but shared interests in the continuation of a particular system pattern,
- goal setting -
    - deliberate purpose or emergent 'attributed' purpose,

- decision cycles - usually replicate but occasionally transform the system's DNA,
- goal blindness -
  - when we are goal chasing we tend to focus on a few related measurable variables, and often forget to ask what effect our goal chasing is having on the system as a whole,
  - particularly on the stock and allocation of shared resources, and the evolution and nurturing of better alternatives,

- limits –
  - stepped ratios, trigger levels, limited resources, falling efficiency, loss of focus, falling standards,

- forces –
  - attractions and repulsions (with range properties),
  - incentives, disincentives – bonus, subsidy, tax, etc.,
  - laws, rules, regulations - to require or prevent,
  - protected environments - exempt from normal forces,
    - monopolies, ring fences, trump cards, rights and privileges, off-shore tax havens, secret societies, professions, unions, self-reinforcing self-interest circles and networks,

- oscillations -
  - delay and inaccuracy oscillations,
  - dependent loop oscillations - wolf and moose, simple, deep cycles, phase planes,

    - multi-loop interactions - complex, non-aligned, chaotic, evolving networks, competing self-interest vs. group-interest networks, labour relations, international trade dynamics, balance of payments resolution mechanisms, dependency vs. self sufficiency, borrow vs. earn/create,

- processes -
    - control of flows, filters, and stores,
    - selection (sorting and filtering), evaluating, iteration,
    - creation or assembly of new entities,
    - changing the nature of entities,
    - destruction of entities,
- measuring -
    - the state of isolated components - variables, dimensions, parameters,
    - the accuracy and timing of; information, decisions, control, goal setting,
    - stocks and flows, shared resources, inputs and outputs,
    - externalities - shared commons, environmental feedback,
    - the whole system - emergent patterns, archetypes, deep structures, phase planes,
- the system boundary – system DNA;
    - design, maintenance, evolution, change and transformation.

Common Systems Problems.

Now let's look at how these core systems **behaviours** group together to create some **common systems problems**.

Once again we will see that we don't really have the shared **vocabulary** to name these common systems problems. If you think of any good catchy descriptive names, spread the word.

But first a selective recap.

- Evolution – produces constantly changing circumstances.
- Open systems exist within that ever-changing, evolving, environment.
- Ask - is the system in question evolving in response to its changing environment, or not?

If the system is evolving – if its behaviour or performance is changing - if its DNA is changing - then **its changes** are contributing to the **changing environment.**

Success and Failure.
Success and **failure change** the **situation**, change the **game**, change the **environment**, change the **local normal.**

We tend to pay more attention to **success** than we do to **failure**. Lets look at some **common systems problems** associated with **success and failure.**

Growth here can result in **decline somewhere else.**

- Growth – success – attracts (sucks in) resources and talent, which deprives the alternatives of resources and talent.
- Success enjoys; economies of scale, economies of networks, etc., which improve efficiency, **initially**.
- Markets reward the successful and efficient, with more and cheaper resources,
- so the strong get **stronger** and the weak get **weaker (self-reinforcing growth and decline**).
- This force can cause;

- new innovations to find it **hard to get established**, to compete,
- new innovations to find it **hard to attract talent and resources**,
- stronger and weaker **partners** to become **adversaries** (think EU).

But the system as a whole **needs innovation**, needs to generate variety,

- evolution = generate variety, select, replicate.

The weak are killed off - but they might have contained **some** good **elements** that might have been useful later or elsewhere. Are those potentially useful elements **recycled** or **wasted**?

- So - How should we facilitate promising research and development in this environment?
- How can we recycle good elements from failed systems?
- How can we develop and apply talent efficiently?
- How can we allocate resources efficiently?

But - Growth slows down in time – things get better - then they get worse.

Limits to Growth.
Growth encounters **limits** when it;

- has unsustainable side-effects, internally or externally – which quietly build up to a critical trigger level,
- outgrows its own capacity to perform – quality falls – products suffer – customers dessert (simple loss), and take their friends with them (self-reinforcing network loss),
- has picked all the low-hanging fruit – then standards become harder to maintain, quality declines – efficiency falls – marginal costs rise,

- hits **resource constraints**;
    - some resources are limited, restricted, finite(ish) - (mitigated by recycling and better technology),
    - some resources are renewable, creatable - skills and education, fractional reserve funny money - it is a balance between cost, quality and possibility.
- **simple resource depletion**, straight line depletion, gradually increasing cost and reducing quality and possibility.
- **self-reinforcing resource depletion**, exponential depletion,
    - the tragedy of the commons - shared unregulated access to the use of limited common resources.
    - Without **regulation/coordination,** success attracts more **users of resources** which can lead to catastrophic exponential depletion of shared limited resources.
    - Cross-border tragedy of the commons can occur, where the consumers are in a different region/system from the source of the resource. This results in long, delayed, and inaccurate information and control feedback loops with large oscillations. The long and sorry history of the mismanagement of international fish stocks demonstrates the mechanisms. Because this situation is so hard to manage, coordinate or regulate, we tend to rely initially on price, and only when that fails do we attempt cross border regulation.
    - Without regulation, success attracts **too many producers** – the price falls, pushing some suppliers out of business. Oscillations. Overshoots. Agriculture is plagued by this problem and by attempts at local, regional and international regulation.
- encounters management, consumer or political **fads and fashions -** which lead to **trivial diversity** – distracting attention and resources away from fundamentals,

- trivial product features, or trivial 'principles', become the new hot topic, creating the impression of new problems to fix,

- resources are directed towards this unproductive new activity, and away from the core activities,

- resources are often directed at **disguising** emotive **symptoms,** rather than **correcting deep causes.**

- encounters our **innate evolved gain / loss asymmetry** - why risk changing something that is working well -

    - group-think often adds **a self-reinforcing perceptual distortion loop** – not many team brownie points awarded for finding fault with a popular product (Jimmy Savile?), forecasting failure, or calling for massive reinvestment in an established cash cow.

- Increasing scale increases the **chance,** and magnifies the consequences, of everyday group-think perceptual distortion and thinking errors, such as; mistaking familiarity-with-the-normal for holistic understanding – denial and suppression – blind spots – propaganda – quick-fixing of emotive symptoms rather than addressing deep causes.

- With increased scale, it can become too expensive to decommission existing inefficient assets and **invest** in new, more efficient technologies.

Sudden Switches.

So at some point, the advantage **suddenly switches** away from old successes, and towards new small nimble alert observant responsive motivated greedy hungry newcomers.

The old scale-based **obstacles to entry** become the **new cause of failure**, and an advantage to nimble clean-slate newcomers.

Some dinosaurs crash and die – very inefficiently – with huge external costs; unemployment, wasted skills and knowledge, wasted assets.

But some dinosaurs are;

- too big, too essential, too interconnected, to be allowed to fail,
- (and too powerful to jail it seems).
- They get protected.
- They get subsidised.
- They get bailouts.

What about government sponsored moral hazard and perverse incentives?

What about reality?

What about learning, understanding what went wrong, and how it was allowed to happen?

We need **to understand what went wrong** in order to set about;

- changing the system DNA for the better,
- redesigning the system of incentives that created the problem, and
- instituting a system of punishments to help focus management's attention, particularly in the absence of a functioning system of moral self-restraints,
- recycling the re-usable ideas and assets.

Learning
is going to be difficult if disclosing the truth could lead to personal punishment – perhaps a 'truth for amnesty' commission is needed in such situations?

- Who should be making these decisions?

- Who should be winding the handle to think through the consequences of changing the system's DNA – given that the people who understand it best, the people who actually know what happened, tend to have a vested interest in particular outcomes – which are not necessarily the best holistic design.

As you read that, you were probably thinking about recent and current problems in the Banking and Finance industry, but all these systemic issues apply just as much to our 'sacred (secular)' public sector institutions as they do to our financial institutions.

- The methods used to maintain the existing DNA and perpetuate the required perceptual distortions may differ - with one sector preferring big bonus incentives, whilst the other uses emotional hijacking, bullying and intimidation, but from a systems point of view - their problems are very similar.

Our traditional political camps have made the common group-think error of mistaking familiarity with understanding. They operate from self-reinforcing, simplistic, emotive, out-of-date, stereotypical, superficial, judgemental, bad-category ideal notions of what the public sector is, and what the private sector is.

- One political group hates the public sector and worships the private sector, and the other does the opposite. These simplistic notions are both way out-of-touch with reality.

We all need to wipe our clouded eyes, remove our blinkers, and take a thoughtful and observant bath, and think about flows, and stores, and goals, and lean and sloppy information and control loops and their consequences. We need to drop our ideological, pre-cognitive commitments, and reach for a clean sheet of paper.

So we have had a quick look at some systemic problems commonly associated with success and failure.

What can we learn from looking at the systemic features typically associated with **new start-up ventures?**

From a systems point of view, a new **start-up** is a very **different** animal from an **established business.**

- The new start-up should be focussed on the **rapid evolution** of the **design** of the new business's **DNA** – setting up a system whose emergent behaviours will produce a **viable, repeatable, scalable, business** – or service.

- New start-up **design decision makers** should be engaged in an **iterative lean-loop interaction** with real world **customers** – turning initial assumptions into more and more accurate facts, developing a **minimal viable product** that perfectly meets the well **understood needs** and **desires** of well **understood customers.**

- New start-up **design decision makers** should also be engaged in iterative **lean-loop** interactions with;

    - distribution channels,

    - suppliers,

    - financiers,

    - potential partners and competitors,

    - turning assumptions into more and more accurate facts with which to build the viable repeatable scalable business model.

- They must decide if their business model is based on **simple** or **self-reinforcing** customer loops (networks).

    - Many businesses are based on a simple loop where the customer has an occasional or periodic need, which the business satisfies. (You need some bricks laying, I lay the

bricks, you pay me. You want some bread, I bake the bread, you pay me).

- But the internet has created new opportunities for network-based businesses - where it is in the customers' self-interests to go and recruit lots of other users to come and join the network or use the service.

    - When land line telephones were first invented, the first customer had no one to call, so it was in his/her interest to encourage all their contacts to get a phone installed as well.

    - This is the network mechanism behind the social media explosion.

- Network based businesses are not new. Early trading networks benefited from having more nodes, and more things to trade. Banks and trade financing institutions benefited from having more branches in more countries, to support the trade. Amazon's customers and sellers both benefit from increasing Amazon's scope and reach.

- Welfare networks, based on the **pooling** of resources and the **sharing** of particular types of risk, benefit from having lots of full life-cycle members (but not from an influx of partial-cycle claimants).

- Welfare networks based on the Ponzi investment scam / pyramid network principle depend on the recruitment of more and more new recruits/investors/young healthy low-paid workers, to generate the promised benefits for the aging founder members - but it is an arithmetically unsustainable fraud - a tempting **public sector bubble**.

- Political movements, armies, nations, empires and trade blocks all gain strength and effectiveness through having large numbers of obedient aligned committed members - until the limits to growth kick in.

In an **established** business or organisation, the main focus is on **maintaining** and **replicating** the **established DNA**. This requires a very **different organisational structure** from a lean-loop start up.

Established businesses have;

- rules, plans, procedure manuals and uniformity,
- hierarchies for the **sloppy-loop, slow-cycle, perception-distorting** monitoring of performance targets.
- This can result in decision makers operating in the dark, **separated** from their real **customers** by;
- layers of inward and upward looking,
- self-interested, self-promoting, tribal-warring, cover-up-prone, reality-denying bureaucracy.

So - established organisations, both public and private, tend to look inwards and upwards – not out at their customers' needs and desires.

Balancing

- innovation, evolution and customer-needs awareness,

with

- system DNA maintenance, and
- bureaucratic self-interest,

is a big issue for all established organisations - public or private.

In the UK - Local government and the NHS appear to have become **spectacularly disconnected** from, and disinterested in, their customers' needs. Their services are guided by very-long-loop political group-think processes, political ideology, and indirect treasury funding, instead of customers paying what they think these resource-pooling and risk-sharing

services are worth. It is about as far removed from a lean-loop customer-needs-focused start-up organisation as it is possible to imagine.

- The human brain tends to compare today's bad service with yesterday's bad service. So we don't notice how bad the service has become.

- We should be making comparisons with the base line - comparing today's bad service with what a good/satisfactory service would look like.

At what **point**, and by what **mechanism**, do we **acknowledge** the **failure** of the DNA of a public sector institution?

How do we facilitate **evolution** and initiate **transformation**?

The **finance industry** is rather different. The central business model of the finance industry is - getting governments to allow banks to create imaginary money out of thin air (fractional reserve banking / creation of loans) – in exchange for lending much of that funny-money **(indirectly)** back to the government - who promise to pay real-money interest (on the borrowed funny-money) out of taxes. Taxes raised on,

- some funny-money funded activity,

- and some real-money, hard-earned, wealth creation activity.

This set-up naturally encourages the development of vicious circles and self-interest networks.

- The government is tempted to borrow and spend more and more money to buy votes, by creating **dependent** jobs, benefits, and services – but it also has to ensure that enough real wealth is created so that there is enough profit to be taxed to enable the government to service its historic debts - to pay the mostly-real-money interest on all the funny-money it borrowed.

What an amazing system. But of course this vicious circle is prone to **sloppy-loop delay and inaccuracy oscillations** – which cause it to **flip flop** between periods of too much benefits, subsidies and government debt,

followed by periods of too much 'austerity' (a poorly defined and highly emotive category - crying out for more subtle distinctions).

All the time the system is operating in a **suboptimal** fashion, just like the temperature of your bath.

So, the **money creation** part of the finance world's activities are based on very sloppy loops. Nothing like the free market or the moral sentiments envisaged by Adam Smith - and yet we call it capitalism - which is another very **shoddy piece** of **categorisation** bordering on an emotional hijack based on trivial association.

The bankers also have the 'difficult' job of **getting businesses** and **individuals** (as well as governments) to borrow lots of funny-money and pay interest on it, thus turning it into real money. (The ultimate money laundering venture).

So they package the funny-money up as; loans for cars, loans for boats, loans for houses, loans for education fees, loans for daily living costs (credit cards), and they provide (sell us) insurance services, in case your car or house or boat gets damaged before you have finished paying for it.

- In case you are thinking that there is no limit to the amount of funny money the banks can create - there is. People and companies may not feel like borrowing any more money. They might feel like paying off their loans and credit cards (which effectively destroys funny money). Individual banks may not want to create proportionally more loans than the other banks are creating, as some of that funny money will end up in the other banks, and then the lender will have to borrow more from the central bank in order to balance their funny books. And sometimes governments have the intelligence to set and manage limits on the banks' reserves to funny money ratios.

Financial institutions also provide saving schemes and pensions, and investment / gambling opportunities.

They provide currency exchange markets and services so we can buy from and sell into foreign currency markets, speculate on changes in exchange rates, and **insure** against unwanted changes in those rates.

- These **insurances** were at the heart of some recent financial problems, and demonstrate a very interesting system behaviour that should remind us that **exceptions are exceptional - so don't assume they behave like the norm.**

- It made sense to both the buyer and the seller, to buy a **single** insurance policy to protect against a **single** currency exchange deal going wrong, **because** the seller of the insurance policy clearly had enough reserves to pay up on that **one** policy, if required.

- The problem was – that in an **oscillating** and occasionally, but **predictably bubble bursting** 'market' – there would arise situations where there were **millions** of claims to be paid – and in that event, the sellers of those insurances could not possibly afford to pay up and would go bust. So the insurance policy would fail - at exactly the time it was needed the most - with catastrophic consequences. Bingo. A fabulous example of an **exponential, network based, tragedy of the commons**.

By now, you already know enough about systems thinking, to be able to see that this is a system with the **potential** for **catastrophic failure**.

- Lending money for mortgages, fuels a real estate asset bubble, which means the banks will be right up shit creek if the housing market collapses because the houses will be worth less than the loans they issued on them, So, to spread this risk around, they packaged the mortgage loans up nicely, and sold them to other people, who paid up front to receive an income stream from all those mortgage payments. To make those packages look even more attractive they sold insurance policies (in case the borrowers defaulted) – which could probably have paid out if a few people had defaulted (a minor oscillation) but not if the whole housing bubble market collapsed (a major oscillation). And in America – the capitalist free market inspired government actually guaranteed some of the mortgages – amazing.

- So when the bubble burst (the 2008 bubble) – there was a hideous mess of dilemmas. Claiming on the insurance risked bankrupting the insurer, who may actually be another department or subsidiary of your own organisation, and even if they are a separate company, the inter-dependencies were/are so deep and so complex that the

whole structure might collapse – taking its **crucial belief system** with it. The looming problem was so bad it was initially **denied.**

- The first public sign of trouble was when the banks suddenly stopped lending to each other – because they all knew, what the rest of us didn't - that none of them were good for the money any more.

Now this is not actually a very difficult problem in systems terms. The problem was a **failure** of the **whole-group health protecting coordination/regulation function** – caused by **extremely sloppy information feedback and control loops. The system DNA was dysfunctional by design.**

- The individual financial deals were/are considered confidential, but that should not prevent accurate summary information being provided to regulators.

- The core problem was that because of valid confidentiality issues, the truth or **accuracy** of the summary information could not be **challenged** or **tested**, so there were huge personal and institutional **incentives** to report **untrue summary information** - as a string of recent market and data rigging scandals have demonstrated.

- Tempting, local, **in-group incentives** and a serious lack of effective **whole-group-protecting disincentives**, must have been, and probably still are, a major root cause of inaccurate and inadequate information being provided to the **whole-group** coordination and regulation functions.

- Maybe there was also a fear of tinkering with such a complex and crucial system when everything, and everyone, seemed to be doing so well out of it.

After the banking crash in 2008 the UK government set up the Financial Policy Committee to identify **risks that threaten the resilience of the financial system AS A WHOLE.**

At last, a whole systems overview to protect the whole group's interests against the self-interest of the individual players and networks. A step in the right direction.

Oh yes – sometimes banks invest in wealth creation projects – but it is rather risky so they prefer not to (except in Germany and China and Russia and India).

- As mentioned above, the nice thing about lending money to buy houses (or any other fixed asset class) is that it sets up a self-reinforcing loop. Giving people mortgages inflates the housing market, which means that it doesn't matter to the bank if people can't make their payments – because the value of the underlying asset has risen in the mean time. So it's a win-win for the bank, and for the purchaser, as long as the bubble doesn't burst.

- So even now – just a few years after the mother of all financial collapses – the western banks still prefer to stoke up asset bubbles rather than invest in wealth creation.

This sounds like a good opportunity for a new finance and banking model to make an entrance.

- I wonder what model the BRICS New Development Bank is developing.

- And as I write, some sections of the labour party are discussing a poorly defined 'people based' version of quantitative easing, and a group called 'positive money' is talking about debt free finance – where the money creation would be controlled by an independent panel and not borrowed at interest from bankers. The Swiss are considering a referendum on whether or not to ban banks from creating funny money - and putting money creation solely in the hands of their Central bank.

- One problem that all monetary systems have to bear in mind is that elected Governments can't be trusted to control the creation of money as they will be unable to resist the temptation of spending it buying short-term, least effort, lowest common

denominator votes - when they should be creating a vibrant stimulating sustainable economy.

So back to the issue of **lean-loop customer needs awareness** - the current finance industry is pretty closely connected with **some** of their customer needs and desires, because their business is based on getting people to borrow some more money, or save some more money, or invest (gamble) some more money.

In this respect it has leaner loops than the public sector.

The big problem in the finance industries is that they need to be regulated and coordinated – to prevent those innate vicious circles and networks spiralling the system out of control - driven by the short-term self-reinforcing self-interest of the various inside agents, and resulting in the build-up of unsustainable critical consequences for everyone in sight (the classic tragedy of the commons).

But our government's continued electoral popularity is **dependent on** borrowing funny money created by the finance industry - and the more exotic financial products are so complex, interconnected, and confidential, that only insiders have a hope in hell of really understanding what is going on. So our Governments are both **scared** and **incapable** of providing the necessary regulation and coordination.

- Perhaps the most interesting feature of this finance system is that it depends on **belief**, on the vast majority of us **not understanding** the **imaginary nature** of the money we are using and borrowing.

- Presumably that is why it has not been openly discussed in the mainstream media, or taught on economics courses, etc.

- Despite its imaginary and secretive roots, this funny-money system has delivered an **amazing increase** in the **standard** of **living** for huge numbers of people since WW2.

- But because of its belief-dependency we have real difficulties **openly discussing** or acknowledging its **strengths** and **weaknesses**, and therefore, its **evolution** is **restricted** – left to a few insiders with vested interests.

We could definitely improve this design – but the risk of breaking the belief, and collapsing the system, is considerable, and the consequences could be quite terrible. Tricky situation.

Back to the **asymmetry** of our relationship with **gain** and **loss, possibility** and **probability.**

- Everyone knows the system is seriously flawed – but who wants to be responsible or accountable for redesigning it – when the risk of an accidental collapse of the belief bubble is so great.

- It is easy to sit in the pub, or the student common room, and mouth off about how it should and could be reformed – but the person in the pub is not responsible or accountable for actually doing the job.

Perhaps the best thing to do, is to equip more people with;

- the systems thinking skills, and the necessary information, to enable them to understand the system,

- the moral maturity and understanding to balance the desires of the individuals and the vested interest groups, with the needs of the whole group,

- and then perhaps they could be trusted to participate in the system's design evolution – and maybe even participate in deciding who could be trusted to decide how much money is created and what it is used for.

So **evolution** is **restricted** in the finance sector - but how does evolution function in the public sector.

What public sector DNA are we replicating and why?

- Are we **generating variety** - trying different approaches?

- Are we **evaluating alternatives**?

- What would constitute **individual** or **group-level success** or **failure** in the public sector?

- Do we identify and replicate **successes**?

- Do we put a stop to **failures**?

- What happened to **responsibility** and **accountability** in the public sector?

- How appropriate is the current system of **incentives** and **punishments**?

- Are we using **lean** or **sloppy**; **design**, **information** feedback and **control** loops?

- How do we design new public sector services?

Simple important questions we simply don't ask.

We could definitely do better.

These **start-up**, **success** and **failure** problems can appear complex on the surface – but actually - we have already met all the key systems concepts needed to understand them.

Here, for the last time, is a summary of the key systems concepts. By now you should be familiar with each of these concepts and able to spot an abundance of examples in daily life.

structure –

- **things**, well-defined high-quality useful groupings of things (categories, classes, etc.), **relationships** between things, local and remote associations, well understood and demonstrable **patterns** of **causation**, awareness of system **boundaries** (control, influence, observation, prediction), system **DNA**, system **replication**, system **evolution, and of course - the environment's DNA and evolution**.

emergent properties -

- explicit **goal** (and ideal state) **setting** and **chasing**, **lean** and **sloppy** design, **information** and **control** feedback **loops** (**timing** and **accuracy**), lean and sloppy **decision cycles**, system **description** **measurement** and **monitoring**, winding the handle to explore the **cycles** of **possibility** and **probability**, **change** (changing the local normal), **transformation** (changing the system DNA - effortless effort), and watching how the environment responds.

which give rise to **archetypal patterns** -

- **simple** growth and decline (addition subtraction),
- **self-referencing self-reinforcing proportional** growth and decline,
- **limits** to growth, many forms of the **tragedy of the commons**,
- **simple oscillations** (regular suboptimal cyclical flip-flops and overshoots),
- **complex** inter-dependent **oscillations** (chaotic suboptimal flip-flops overshoots and crashes),
- inter-dependent interacting self-interest circles and networks,
- interconnected **success** and **failure** patterns,
- attractions, repulsions, protected areas, rights, privileges and trump cards.

the **approach** -

- respect for truth, reality and evolution,
- whole system focus whilst recognising the strengths and weaknesses of isolating reductive analysis, categorical logic, and statistics,
- deliberately considering multiple view points,

- deliberately resisting the perceptual distortions of group-think and the momentum of vicious and virtuous circles and self-interest networks.

the **goals** -

- maintaining the **health** of the **whole group**, **stimulating** individual **creativity**, **pooling** and **sharing** of **risk**, setting effective limits on **cheating** and **freeloading**,

- managing **institutional bureaucratic self-interest** (inward and upward focus),

- balancing **individual**, **sub-group** and **whole-group** needs, to achieve a healthy hive of thriving stimulated individuals.

achieved by -

- **acknowledging and managing** the **system's DNA** - the **'normal' assumptions** and **perceptual distortions** (filters and spot lights, ideas, visions, values, goals, structures, agreements, contracts, rules, procedures, regulations, sensitivities, measurement paradigms, analytical frames, understandings) that direct the system at each moment of its replication.

- managing the **forces** of **attraction** and **repulsion,** incentives and punishments (perverse or beneficial), inclusions and exclusions, rules or laws requiring and prohibiting ...,

- managing **regulation** and **coordination** - set and maintain quantitative and qualitative standards, balance supply and demand, detect systemic interdependency threats, guard against tragedies of the commons, and resist and direct the enormous attraction of private and public sector **bubble-surfing**.

- **watching out for**, and **setting limits** on;

- the activities of **self-referencing, self-reinforcing, self-interest networks** -

- vicious circles, cartels, monopolies, secret societies, unions, religions, political parties, ideologies, regions, nations, states, trade blocks, empires, armies, etc.,

- protected areas, ring fences, rights and privileges, trump cards, ideological taboos,

- promoting individual and group learning;

    - the aim should be; observe, understand, decide, take action, observe again, learn,

    - **not** - follow group fashion, bodge it, issue propaganda press release, deny reality, move to new job before the results are in.

    - Group **learning** can achieve amazing things.

    - Group-**not**-learning can be very destructive.

    - Group **distraction** (by hot trivial marginal topics) wastes resources.

Group learning requires lean strategic-responsibility-feedback loops,

- lean accurate honest checkable and timely feedback and control loops, going to and emanating from the responsible accountable decision makers,

- **respect for reality** and the continuous **update** of **shared models** as required - stigma and punishment of intentional denials and cover-ups,

but -

- group-think / group-bonding, often requires the **denial** or **avoidance** of **evidence** of **reality**,

and -

- collective responsibility often breaks the personal responsibility chain, making it **impossible** to identify **individual responsibility** and **accountability.**

So - Where do **you** stand on **evolution**, the **generation** of **variety** and **alternatives**, the **judgement** and **management** of **success** and **failure?**

Where do you stand on **reality**, individual learning, **group-learning** and **group-think?**

What value do you place on **order**? Do you know how **difficult** it is to **create** and **maintain order in a changing world**?

- Do you prefer impulsive rebellious **change** for the hell of it, or well considered, well understood, well thought-through, handle-winding consequence-considering **evolution**?

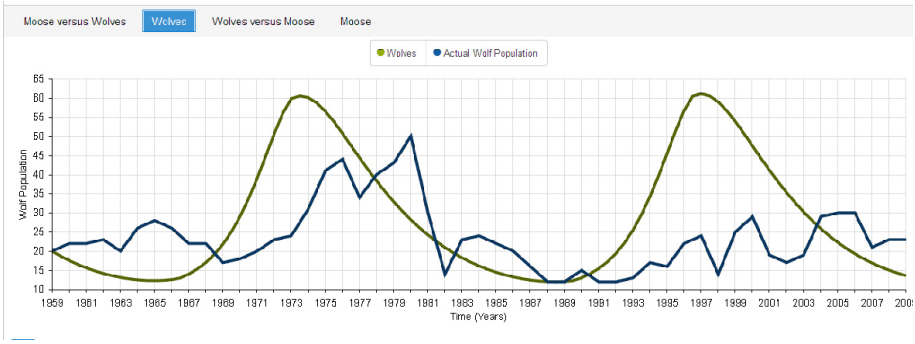
- Do you understand the difference between **constructive strife** and **destructive strife**?

Chapter *5*

Modelling - understanding, communication and selective perception.

Understand and remember that;

- the model is not reality,
- the map is not the territory,
- a model is just one of many possible, simplified representations of reality.



All models are **flawed** because they are the result of;

- reality + our perceptual distortions and omissions + modelling technique limitations.

Flawed though they are, our **interaction** with **reality** is **entirely mediated** by our **models** - which **trigger**, **frame** and **shape** our;

- emotion and perception,
- understanding,
- awareness of options, power balances, and risks,

- predictions,
- choice of goals and strategies,
- decisions,
- communication strategies,
- allegiances.

There are 2 important **types** of **model;**

- **Neural models** - the current models of reality that **exist as** the current structure and behaviour of our **experience-trapping neural networks**. These models/structures drive our **fast system** – our rapid response intuitive and emotional reactions.

- **Social models** -

    - socially agreed pragmatic models (e.g., the highway code, manners, protocols, laws),

    - group-think models (e.g., ideological, religious, political, self-interest group, team loyalty),

    - theoretical models (hypothetical scientific – use it for now but keep testing, reviewing and updating).

There is usually some degree of **mismatch** between our **neural** models and our **social** models - **our first reaction** will be driven by the **fast** neural model. The **slower** social models **may** kick in a bit later. And they **may not**.

- A social model **may** be fully integrated with our fast neural models and may thus control all our related behaviour.

- But even if it is **not** fully neurally integrated – a theoretical, social, political, religious, etc., model **may** still influence our behaviour **via** our **slow** system**, if it is engaged.**

- **If** the slow system **isn't** engaged, it may not influence our behaviour **at all.**

Narrative Bonding.
A defining feature of human beings is our ability to group together around a shared narrative. It makes sense evolutionarily – simply because well-bonded groups **tend** to **survive** better, and **compete** more effectively, than weekly-bonded groups.

- A driving force in this bonding process is the relief from anxiety offered by a superficially coherent and socially agreed explanation of remote causation.

- Our neural networks are very good with local causation – detecting and updating our understanding of close associations in time and space, but we struggle with remote causation. So a narrative, any narrative, that appears to tell us why, rare but disastrous events such as earthquakes, volcanoes, famines and pestilence happen - and what to do to prevent it - are very welcome.

- It frees our attention to focus on more productive topics.

The down-side to this evolved human narrative bonding tendency is that we often **imagine patterns** of remote **causation** that have **little or no connection with reality**.

- Given the wrong circumstances, these can grow into **ideological grand narratives, binding** people into **self-reinforcing groups,** based on invented and deeply **flawed patterns** of **causation.**

- The **bonding power** of a group's **narrative** is **not** related to its **objective truth,** only to its **perceived truth.**

- Historically, the **truth** of these assumed patterns of causation, often didn't matter much, if at all – particularly in the face of rare events which people actually had **no control over,** and which **could not** be **predicted** or **avoided.**

- It did and **does matter** if a group's chosen narrative is **preventing** it **predicting** and **avoiding** disasters which are **predictable** and **avoidable.**

- It did and does matter if a group's **enemies** have adopted narratives that **result** in them;

    - developing more effective technologies than you,

    - or having fewer moral constraints about killing or subjugating you.

Social models and group narratives **evolve.** Historically a great variety of narratives have been generated, some survived better than others, and were replicated.

Some continue to evolve, and some don't, because they include features that prevent them evolving.

Ask yourself - are your internal **neural** experience-trapped models and their accompanying narratives, your **social** models and narratives, and your special **mutual-interest** group's models and narratives, in sync with each other?

We humans are capable of operating **many contradictory** models at once. We can spend our working day promoting models of equality and social justice, whilst our children are being looked after by a foreign nanny working long hours on less than the minimum wage.

Does this **contradictory models concept** help us **understand** the **difference** between the Public Sector's proclaimed **intentions** and **commitments,** and the **reality** of public service performance.

- Officially there are all kinds of public statements about public sector standards and principles – but at the front line, the service is actually delivered by **individuals,** who can recite those official **(slow** system) standards verbatim, but whose **treatment** of the **customer** is actually driven by a **complex interaction** of powerful, **fast** system, **internal neural-network reactions.**

- The front-line or back-office worker may be a committed member of a religious group, an ethnic group, a political self-interest or group-health network, etc., each with its own, **fast system, group-binding narratives** and **principles,** which may **contradict** or **outweigh** the employers, **slow system,** public standards and principles.

How do Neural Models and Social Models Evolve?

- Sometimes it is a **digital,** win or lose, dominate or crash and burn process.

- Sometimes there is **continuous refinement** - learning and adapting through efficient lean feedback, inefficient sloppy oscillations, or chaotic change.

- Often we just keep bashing on in the same traditional, heuristic, tried and tested fashion - **despite;** evidence suggesting the approach **isn't working**, or that there has been a **significant** and **relevant change of circumstance**.

Neural model update - the **learning curve.**

- Our experience-trapping neural networks are updated by the flow of experience. But not every experience changes / updates our neural networks. There is a learning curve.

- Initially we may be completely unaware of some aspect of reality, then something happens that causes us to become aware of it. We usually **pay** a lot of **attention during** this **phase, until** we achieve a **coherent understanding.**

- Some people stop paying attention once they have achieved **superficially coherent understanding,** others are driven to achieve **deeper coherence,** but once that is achieved, they too, tend to pay much less attention.

- This is the **belief stage** - where we are satisfied with our level of understanding and feel no need to question or learn any more about it. In the belief stage, we are more likely to **adjust** (distort,

filter) the **evidence** to **fit** the **model,** than to **adjust** the **model** to **fit** the **evidence.**

- Established beliefs can be disturbed, but it usually takes a **catastrophic mismatch** between the **model/expectation** and our **experience** of **reality,** to bring that about.

- Many beliefs are self-reinforcing – defined in ways that leave no opening for questioning. For example, I know a man who insists that there is no point searching for evidence about the hidden class of world rulers, because they have, obviously, already destroyed all trace of their activities. That may sound a bit extreme, but actually, this style of **belief defence** is **extremely common.** We **all** do it. Some more than others.

- Most beliefs are **maintained** and **defended** by **perceptual distortions** and **filters** that **prevent** the holder **perceiving any contrary evidence.**

- **Weak** and **undefended** beliefs **don't last long** in an ever changing world.

- **Enduring** beliefs are either **true, useful** or **well-defended**. Try to figure out which.

The **evolution** of **social models** is of course a huge subject - but it may help to look at a few different types of social model.

- The **scientific method** has evolved slowly, cross culturally, over 3000 years or more. The narratives told about its development pivot around the achievements of a few sainted and sanitised heroes.

    - Historically, almost all its strongly held ideas have turned out to be wrong, but it genuinely **does want** to **learn from its mistakes.**

    - In the process, it has **restricted** its field of enquiry to areas where **measurement** is possible. Knowing more and more about less and less is a common and valid criticism. It has

achieved great things – but it needs to address its inability to handle holistic systemic thinking.

- **Ideologies** and **religions** – usually have some sort of **original texts** laying down core ideas. The core text is **often** considered **perfect,** so there is **no need for evolution** – only interpretation in changing circumstances.

    - These groups usually embody powerful mechanisms to hold the group together, and defend its central narrative. Some even have rules to prevent members leaving the belief-group. Many have rules to encourage the spread and replication of the belief. But there are also, usually, contradictory evolutionary forces that want to make changes to the core ideas and narratives - which results in suppression, warring factions and splinter groups.

- **Pragmatic** mutual-self-interest groups – are primarily interested in 'vector alignment' – **getting their members pulling in the same** direction – so they like to avoid any unnecessary or contentious issues that might weaken vector alignment. Their pragmatic outlook has a high respect for reality - so any problems such groups have, perceiving or responding to changing circumstances, are probably good examples of the distorting effects of group-think.

- Most (rag-bag) political parties enforce very high levels of group loyalty whilst they compete for the support and votes and funding of almost anybody and almost any interest-group network. In good times the members suppress their differences and toe-the-line in exchange for the benefits of group membership. But in bad times, when the party has few benefits to distribute to its members, those suppressed tensions and contradictions erupt. This results in **cohesion oscillations** – periods of **artificially high cohesion** followed by an **exaggerated collapse** of **cohesion.** Both suboptimal.

Smooth Cognitive Evolution.

Clear accurate timely **cognitive update** and **implementation** is hard to achieve.

Can slow system analytical thinking and learning, update our fast system experience-trapping neural models? Yes It can. It depends where you are on the learning curve.

- If you are still paying a lot of attention, then a theoretical framework can provide a scaffold around which your experiences are shaped and connected into a coherent neural model.

- Sometimes the introduction of a theoretical framework can add coherence to previous experiences - this is usually accompanied by a eureka feeling, as the electrochemical changes cascade through your neural networks. This often produces laughter and a strong desire to communicate the discovery to others.

But once a coherent neural model is established - it can take a lot to change it.

- Presumably evolution favoured individuals and groups, who commit to a plan until it is clearly failing, over people and groups that blow with the wind, and change their minds/models every 2 seconds. Both approaches cause suboptimal oscillations but commitment enables larger, more noticeable, successes and failures.

Can slow analytical thinking and learning update social models? It depends;

- science - yes within the limits of the field, time, place etc.,

- ideology and religion - tricky, chaotic, unpredictable, difficult if the core text is considered perfect,

- pragmatic self-interest groups - yes, if it is a lean healthy group, well grounded in reality.

Are our models tested?
Neural models. We are suckers for superficial coherence. We don't usually test our fast system models unless there is a major coherence failure, but we can learn to adopt a habit of checking our assumptions.

This habit is much easier to put into practice in a **group culture** that **supports,** and **values,** the **questioning** of **assumptions** - and vice versa.

Social models. How well would the default models currently on offer in our cultures, stand up to slow deliberate analysis and testing?

- Many current models have been tested in operation and found wanting, and yet these models persist.

- This is in part because our public policies tend to be **democratic compromises**, rather than pure expressions of a coherent model. So the promoters and defenders of the various models can always claim that; public housing **would** have been a success **if** it had been universal and fully funded, comprehensive education **would** have been a success **if** all other forms of education had been abolished, the free market (operating within the frame of The Theory of Moral Sentiments) **would** have done more to eradicate poverty **if** it had been consistently applied.

- We humans have evolved to be very efficient **detectors**, **followers** and **enforcers** of subtle, and often unspoken, social rules.

- We are often **very bad** at **testing** our **default social models** - and happily accept them as an act of faith, as a demonstration of **group-think compliance.**

- What percentage of our daily media output is directed at **testing, updating, evolving** our **default social** models? **Not enough**.

So - question the **quality** of your **internal** and **social** models.

- What is the **quality** of each of your experience-trapped **neural models?**

- Are they based on a lot of experiences, gathered in a wide range of different roles and circumstances, or a one-off traumatic event?

- Are they **built on,** or even **perpetuating, pre-existing beliefs and perceptual distortions?**

- Do they need updating?
    - Who is responsible, and accountable, for updating them?
    - You are of course.
- What is the **quality** of the **social models** currently on offer?
- Have they been tested?
- Are they **built on** or even **perpetuating, pre-existing beliefs and perceptual distortions?**
- Do they need updating?
    - Who is responsible and accountable for updating them?
    - Hum - hard to say,
    - and herein lies a major problem for groups.

Are your **internal** and default **social** models in **sync?**

How do you balance;

- getting closer to reality,

and

- being a good group member,

when

- your group is demanding **commitment** to the **denial** of **reality**?

Can you find a way to do both - be a good group member and maintain a commitment to reality?

Formal Systems Modelling
is a **tool** that can help us apply our **slow brain capabilities** - to the task of **checking out,** and **improving** the **quality** of our **internal** and **social models.**

It is a tool that can help **create** a **social context** which;

- **helps** to **switch off** the powerful emotional associations of fast think,
- **supports** a **freedom** of **thought** that might otherwise be impossible, because of the restrictions of group-think,
- and helps us uncover the **simple** and **self-reinforcing perceptual distortions** that are inherent in both; evolved human **I**-think and **Group**-think.

So - Develop Your Systems Modelling Technique.
There are many different modelling techniques available. Which ones to use?

Modelling techniques should assist in;

- making our **intuitive** understanding **explicit,**
- **communicating** that **understanding accurately** to **others,**
- **updating** and **improving** the **quality** of our **understanding - updating both** our **neural** and our **social** models,
    - considering alternatives,
    - working through their consequences,
    - making predictions,
    - making decisions,
    - **individually,** and in **groups.**

Things to consider when **evaluating systems modelling tools.**

How well do they handle;

- **Structural** components;
    - things, objects, classes – and their properties,
        - identifying and resolving **category-quality** issues,
    - **relationships** between things – and their properties,
        - independence, dependence, cause and effect,
        - description - algorithms, formulae, conditionality,
    - **groups** of **relationships**;
        - feedback loops - information and or control,
        - goal setting and decision points – accountability and responsibility,
        - lean or sloppy loops – accuracy, timing,
        - action algorithms - sequence, selection, iteration,
        - self-interest networks, virtuous and vicious circles, perverse incentives,
    - **interactions** between **multiple feedback** and **control loops**,
    - interactions between multiple **self-interest networks**,
    - flows and stores - control of, trigger levels, limits, filters,
    - environment,
        - external feedback chains,
        - shared resources,

        - renewable or finite,
        - simple or self-reinforcing depletion,
    - levels of detail – how to handle levels, zooming in and out, black boxes?

- **Dynamics** - emergent behavioural archetypes;
    - independence, dependence, cause and effect,
    - simple growth - simple addition,
    - reinforcing growth - ratio addition,
    - goal setting, chasing and balancing,
    - limits - simple or self-reinforcing, stepped ratios, trigger levels,
    - forces;
        - attraction and repulsion (range), conceal or disclose, compete or cooperate, evolve or stagnate, accept or deny (reality),
        - v & v circles and networks, and commons tragedies?

- **Measuring** the **static** and **dynamic** state of the system;
    - isolated variables, dimensions, parameters,
    - both internal and external variables,
    - support for winding the handle;
        - exploring / simulating the whole system's dynamics from multiple viewpoints,
        - deterministic simulations,

        - probabilistic and multi-agent simulations,
        - dynamic spatial or graphical animations?

- Boundary properties;
    - **open** and **closed** systems,
        - control, influence, observe only,
        - prediction - the uncontrollable and the imprecise, can still be understood and predicted to some extent?

- system DNA ;
    - the local dominant ideas and organising principles that control the system's continuous regeneration - assumptions, ideologies, beliefs, symbols, rituals, perceptual filters and distortions,
    - cycles of possibility and probability,
    - evolving the DNA,
    - maintaining the DNA?

- Communication;
    - Is it widely reliably understood?
    - Does it have an agreed syntax?
    - How far can you get with intuition? Do you need to know the syntax?
    - Does it provide a complete explanation or does it still need discussion and explanation?
    - Does it support evolution – generate variety, selection, replication?

- Will it be useful as a group-thinking tool, to help achieve vector alignment and conflict resolution;
    - exploring how people's perceptions and models vary,
    - converting shallow understanding into deep structural and dynamic understanding,
    - promoting the awareness of options and alternatives?

If you want, or need, to do some formal systems modelling I suggest you begin by looking at these two tools -

- ERM (entity relationship modelling) - very good for exploring system structure and for checking the quality of your categories - it has a precise syntax, but you can get a long way with intuition. I have found it a good communication tool for engaging non-experts in a collaborative exploration of their different models of reality.

and

- Insight Maker. a great introduction to system dynamics with deterministic, probabilistic and multi-agent based simulation.

The Computer industry has developed a set of modelling tools called - UML - Universal Modelling Language, which includes ERM, but often goes into a lot of detail, which is required for building computer software, but is not immediately accessible to non-experts.

Many industries have developed modelling tools specific to their needs -

- architectural drawings - engineering drawings - 3d dynamic design animations - software to control machining equipment, robots, 3d printers, etc.
- software for managing loading and weight distribution on ships and aircraft,
- retail logistics, stock management, transport planning, etc.

Our Innate Human Obstructions to Continuous Learning.

Attention is a **precious resource** which is normally managed and **rationed** by the **fast system**, but the slow system **can override** the fast system, and take control of the direction of our attention.

The fast system has a **default learning curve -** initially unaware, becomes aware, pays attention until it achieves a coherent understanding, stops paying attention, stops learning - moves the focus of attention to something else.

The fast system tends to be blissfully **unaware** of its own cognitive DNA. Its perceptual filters, taboos, frameworks, paradigms, ideological rationalisations and belief defences **all seem perfectly normal,** not at all biased or distorting, **so it often sees no need to switch on the slow system.**

- Framing and perceptual distortion are emergent properties of our evolved neural network brains. This is the deep cause of the phenomenon often called pre-cognitive commitment, confirmation bias (or rejection bias).

The slow system offers the **possibility** of the **continuous evolution** of **understanding** - whereas the fast system evolved to be happy with **superficial coherence** and **group cohesion.**

So continuous learning requires an awareness, and a balancing, of the **strengths** and **weaknesses** of the **fast** and **slow** systems.

If our **goal** is **smooth cognitive evolution** - it requires that we generate a variety of models, judge them, and replicate the winners - but practicality and survival require that we achieve this **without** being **immobilised by uncertainty and indecision - without flip-flopping, in response to every new piece of information, and without damaging our personal or group vector alignment.**

If you are trying to achieve **smooth cognitive evolution in a context that includes multiple-belief systems** (i.e. almost always), be aware that our powerful **evolved belief-defence mechanisms will probably kick in - in everyone - even you.**

Try to **postpone** thinking that things are **good or bad,** as this **triggers powerful emotional distortions** in everyone**.**

If you want the truth to stand clear before you,

never be 'for' or 'against'.

The struggle between 'for' and 'against'

is the mind's worst disease.

Seng-ts'an - sixth-century Chinese Zen master.

Try to **be OK** with; people, events, conditions - exactly as they are - nothing added, nothing removed, nothing denied or distorted, for this will help you **observe reality more accurately.**

(but already you are not OK with that idea – you are thinking its too passive, devoid of principle or passion)

Commitment to dealing with **reality as it is**, is more empowering than **enslavement to a string of temporary, flip-flopping, emotional, cognitive distortions.**

Authenticity and cognitive honesty attract committed followers.

Group-think is the other side of the coin. It has **a tendency to suppress deny and distort reality.**

- Group-think is psychologically powerful, it creates heroes and demons, it justifies the intimidation of others and it generates a feeling of superiority which some find seductive and addictive.

- Its about looking good – and making the others look bad – using trump cards based on isolated, emotive reference triggers, and pseudo-universal principles.

- It both denies and justifies its own perceptual distortions.

- It limits discussion.

- It is not about systemic integration - or the whole-group-health dimension of our evolved moral matrix.

Authenticity, and commitment to reality, periodically create committed, aligned, reality-based groups.

- Group-think gradually destroys them.

Bingo suboptimal oscillations.

How should a systems thinker respond – when dealing with flawed group-think? Here are a few responses to consider - but only if you are sure it is safe to do so.

> Well - I too am concerned about X and Y,
>
> but I am **also** concerned about ;
>
> > the **integrity**, **coherence** and **health** of the **whole system,**
>
> So I think we must;
>
> > try hard to **avoid** allowing our **thinking** to be **hijacked** by any **simplistic-fashionable-emotional-racquets** (find a more diplomatic way to say it though),
> >
> > because these passions and fashions so often lead to dangerous distortions in our perception of reality.
>
> I have been listening carefully to what you have said, but I find that I don't share your models, your analysis, your values, your principles, your predictions, your goals, your methods, your reasons, your justifications, your narratives.
>
> I predict - that if we followed your analysis, and did what you recommend, then XYZ would happen – and that is not where I want to be going. I don't think it is where you want to be going either.
>
> But it has, as always, been very interesting to get a glimpse of how other people are choosing to perceive and experience the world.

Hum. The problem with that approach is that it is probably going to alienate people. It is hard enough updating our own flawed models. Influencing other people to update their models is even harder. It is difficult even under the most benign of conditions - so why make things worse by alienating them.

Dale Carnegie gave us some very sound advice in "How To Make Friends And Influence People".

Sometimes we update our schemas / models (change our minds, learn) spontaneously, without any resistance. But often, we resist change and cling on to dysfunctional models despite a plentiful supply of evidence that the model is flawed. There are good evolutionary and neurological reasons for this cognitive commitment / cognitive bias. We all do it. Some of us realise it and try not to.

Fast mode thinking, and groupthink in particular, work by applying existing models, cognitive clichés. Slow mode thinking offers us the possibility of smoother cognitive update. The smart, evolved, evolving thing to do is to try to be aware of the dangers of cognitive commitment, and deliberately engage the types of slow thinking that make it easier to recognise and accept that a model is failing, and needs updating.

When we are thinking as an individual - I-think, we can be really quite good at updating our own models. You have an idea about what is wrong with your car's engine management system, a section of computer code, or the recipe for a cake, but when you act on that idea you find out it was wrong. No problem. We just build a new model incorporating the new 'learning' and try that.

But sometimes even I-think encounters resistance because we are not yet psychologically ready to drop an established model, to accept that it is failing to explain or predict important events, and replace it with a better model, one which fits more coherently with our experiences, and with our other current models and beliefs.

Group-think involves other people. We change our model to impress or agree with someone we like, someone we need a beneficial alliance with, someone we respect, to be popular or influential in a group, to avoid punishment, stigma or social isolation. Beliefs have a powerful social component. Do not kid yourself that they are purely rational.

You have to **like** and **trust** (or **fear**) someone before you can learn from them - before you will change your schema to please them, to be like them or liked by them.

Most of us would agree that voluntary spontaneous learning is better, more efficient, more sustainable, than fear based learning. Although in the short term it can be hard to detect any difference in the resultant behaviours.

Telling someone they are morally or factually wrong, stupid, uneducated, uninformed, biased, bigoted or irrationally phobic will probably not result in their liking you enough to want to see the world the way you do. When our models are attacked in this way we usually become even more attached to them that we were before. Sometimes we don't even know we have beliefs until they are attacked.

Arguing, contradicting, interrupting, correcting, challenging someone who is still committed to their existing model will never win their good will. I am right, you are wrong, I am good, you are bad, will almost certainly make them defensive and resistant - and is very unlikely to result in them adopting your schema. It might work with a very young child or an adult who is very inexperienced in a new field, but it is not going to work with an experienced adult.

Arguing is particularly ineffective at achieving model update if it happens in public and you are effectively attempting to humiliate your 'opponent' - criticising their intelligence, judgment, honesty, moral integrity, undermining their self respect, causing them to loose face in front of their community - implying they are incompetent or corrupt or not important.

However, if you make their employment, their pension or their grant funding, conditional on publicly supporting your preferred / required schema, many will conform, superficially, for a while. But this may well set up a long wavelength sloppy-loop-oscillation.

Why do we get so attached to beliefs? Our models and beliefs protect us from the anxiety and uncertainty of remote causation - what will happen to sales if X Y Z happens? Accepting that a model is wrong means facing that anxiety, and the prospect of spending a lot of time and effort finding a new model. It can also mean social uncertainty and isolation if your social group still requires uncritical belief in that model.

There is also the question of possession. They are 'my' beliefs, and that little word 'my' is one of the most important words in human affairs. It has the same force whether is it 'my' dinner 'my' dog, 'my' house, 'my' father, 'my' country, 'my' religion, 'my' culture, 'my' ideology, 'my' belief, 'my' flawed assumptions or 'my' cognitive biases.

We often pay little conscious attention during the passive formation of our beliefs but defend them with a passion if someone proposes to rob us of their companionship.

We like (our neural networks are hardwired) to continue to believe what we have been accustomed to accept as true, and the resentment aroused when doubt is cast upon any of our beliefs leads us to seek every manner of associated rationalisation for clinging on to them. The result is that most of our so called 'reasoning' consists in finding arguments for going on believing as we already do.

Carl Rogers - Our first reaction to most of the statements we hear from other people is to judge and evaluate, rather than try to understand. 'That's right,' 'that's stupid,' 'that's abnormal,' 'that's unreasonable,' 'that's inappropriate.' Very rarely do we really try to understand what the other person has said or their reasons for thinking it.

> Any fool can criticise and complain - and most fools do - it takes character and self control to be understanding and forgiving.
>
> Galileo - You cannot teach a man anything - you can only help him find it within himself.

So - sometimes people update their models / schemas easily, fluidly, as soon as a better, more coherent, more pragmatic model becomes available - and sometimes they don't.

IF and only IF they have decided they LIKE and TRUST you - THEN they just might be open to influence, prepared to join in a cooperative exploration, able to hear a neutral outsiders observations and suggestions.

Dale Carnegie suggests they are more likely to like you if -

> you genuinely listen to their point of view - hear then out, acknowledge their efforts, their good intention, their contextual constraints, their

depth of experience, their importance (everyone wants to feel important), and demonstrate that you appreciate and respect them.

Then - focus first on points of agreement. Agree that it is an important issue - agree with many elements of their structural analysis of the problem, etc..

Promise to look over their ideas carefully so that you can fully understand them. Much better to agree to think about their points than to confront them.

Thank them sincerely for their interest, their participation. Anyone who takes the time to campaign for improvement is clearly interested in the same things that you are. See them as people who really want to help improve their situation.

Postpone judgement - postpone action - to give all sides time to think it through - calm down - check assumptions - 'facts' - consequences.

Agree the date of the meeting.

Don't appear superior or infallible - admit promptly to your own perceptual or behavioural errors. Demonstrate that you want to learn from their experience and from your mistakes.

Honest sincere appreciation goes a long way. People like to be appreciated - people work better when motivated by approval than when controlled and constrained by criticism.

If they **like** and **trust** you - if they believe you are genuinely neutral (not secretly partisan) - if they think you might be able to help them get what **they** want - if they think there might be something to be gained by exploring **their** problem using the tools of systems analysis - then they might agree to be **guided by you on the application of those tools, and only on the application of the tools** (no subtle manipulative secret agendas), and on that journey they might find themselves spontaneously **updating their own** models and generating **their own** new possible practical solutions **for themselves**.

I strongly recommend Dale Carnegie's "How To Win Friends And Influence People".

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