Creating learning organisations and systems that are understandable

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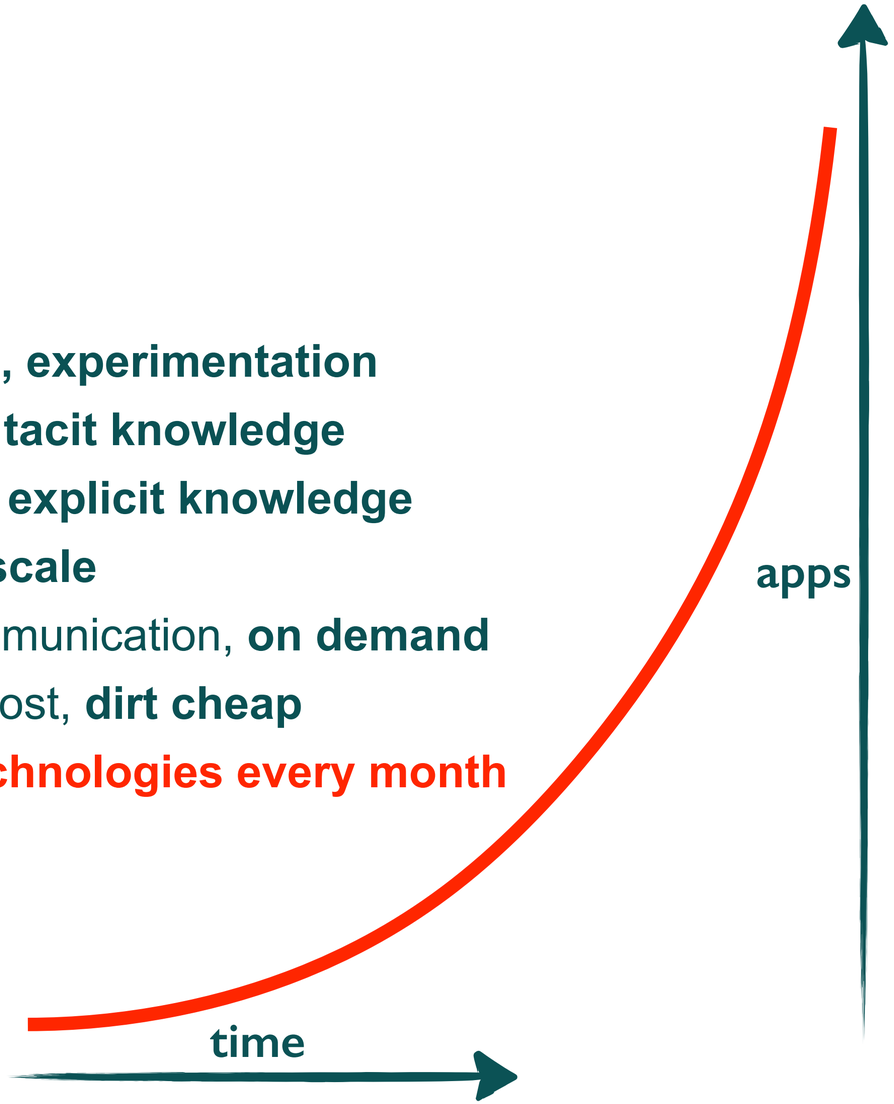
SKA Colloquium, AUT, Auckland, 16 February 2018

Exponential change in communication

- **1,800,000 years**: Cumulative cultural transmission, **teaching, imitation, experimentation**
- **200,000 years** : Spoken human languages — local **communication of tacit knowledge**
- **5,400 years** : Written human languages — communication across time, **explicit knowledge**
- **600 years** : Printing press — 1-to-many communication across space, **scale**
- **180 years** : Electrical telegraph & telephone — global peer-to-peer communication, **on demand**
- **15 years** : Internet — global 1-to-many communication, zero marginal cost, **dirt cheap**
- **Now :** Internet of things – machine-to-machine communication, **new technologies every month**

2 million years of gene culture co-evolution



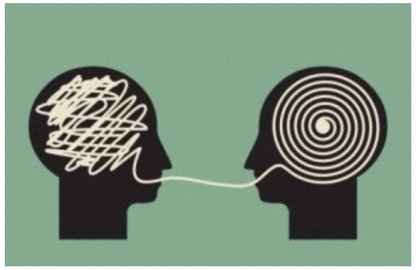
The atoms of **the “language” of thought**

Human mental models have been around for much longer than human language. Here is a synopsis of the thinking tools that predate human language:

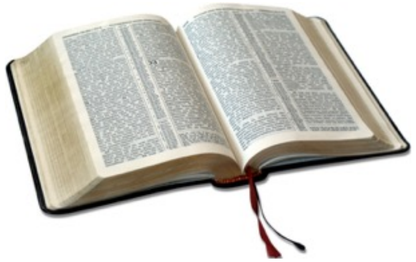
- **Shared attention** (awareness that another animal is looking at the same thing)
- **Pointing** (based on having limbs)
- **Mental representations** (= models) of the things we interact with
- **Categories** (= mental models of groups of similar things)
- **Containment** and **connectors** (spatial relationships between things = graphs)
- **Operations** (mental models of patterns of movements and changes over time)
- **Simulations** (to predict events and arrive at decisions)

Achieving **shared understanding**

Prior to spoken or written language communication via **shared attention and pointing** was the was way of establishing shared understanding, and such shared understanding **related to very down-to-earth representations**. Pre-language humans communicated **within a highly local context in space and time**. The things being referenced were “close at hand”. It was reasonable for people to assume that others understood what they referred to. The risks for **misunderstandings were limited**.



Spoken language entered our world as a serialisation format for communicating simple references to things within our local context. We started to reference **abstract things**, **references to references**, and **experiences that occurred many years ago**. The number of **misunderstandings** in communication **grew exponentially.** Since people could not visit the past of other people, this lead humans down the path of extensive **social delusion**, where they started to **assume that they understood each other much better than they actually did**. The seeds for storytelling had been sowed. The **first human hive minds** emerged.



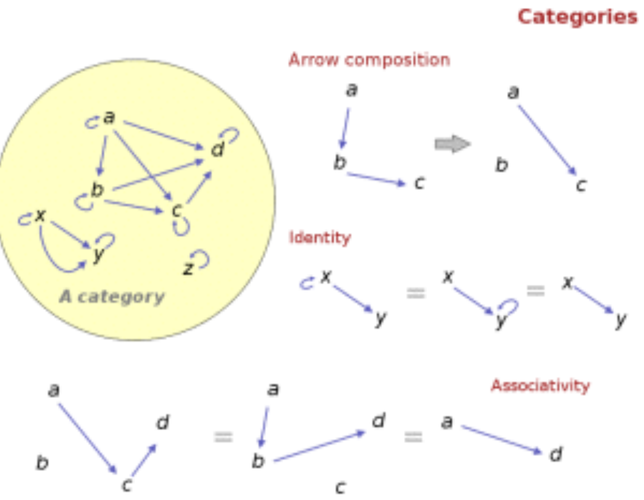
Written language made things **worse in terms of the scope of social delusion**. People had opportunities to “read” large volumes of **information out of context in space and time**. People started importing **many thousands of references to very unfamiliar abstractions** into their mental models on top of their first hand experiences. The human tendency to believe in the validity of our imagination after hearing or reading a story allowed storytelling and **belief systems** to rise to new heights. **A few people started scratching their heads** about weird human behaviours and the beliefs that underpinned the observed behaviours.

Transdisciplinary projects

Transdisciplinary projects are shaped significantly by context, triggers, and **rituals, and subconscious adherence to paradigms.**

To minimise the risks of collaboration failures **it is important to understand how do new paradigms or dogmas emerge.**

Modern mathematics



At all times throughout human history a few people would have realised that human language has severe limitations in terms of ambiguity and precision.

Given the limitations of human languages, it is perhaps not entirely surprising that modern foundations of mathematics take us back to core concepts that pre-date human language – to the atoms of the language of thought:

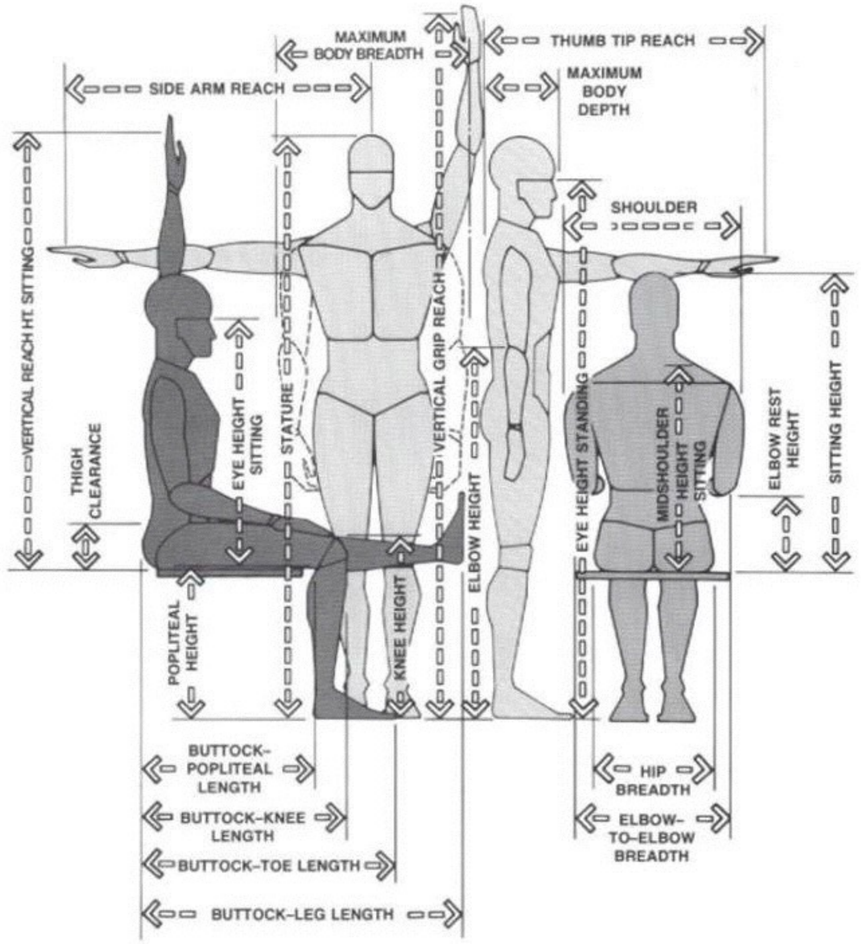
- **Model theory** expresses the biological foundations of human mental models in a formal symbol system.
- **Denotational semantics** is based on the simple observation that we can abstract human understandable symbol systems into corresponding machine readable symbol systems.
- **Category theory** is a thinking tool for articulating large scale patterns and establishing semantic equivalences between different domains, it does not involve any concrete symbol systems. We perform such semantic calculations in our minds all the time, mostly subconsciously.

Transdisciplinarity is at **the core of value creation**

Diverse knowledge is necessary to solve various problems in the world and to create value in the future, and overcome challenges that go beyond the framework of research in industry, government and academia.

[from the mission of the Honda Research Institute]

Creating visual languages and interaction styles
that are better than English or any other linear language



Human scale computing can be understood as the elaboration of the role of cognitive characteristics of humans within ergonomics.

Systems, models and technologies are only understandable as long as they do not generate cognitive loads that exceed human cognitive limits.

This observation can only be put to good use if human cognitive limits become a primary concern in the design of human institutions and technologies, in much the same way that human scale physical dimensions and characteristics have shaped the discipline of ergonomics.

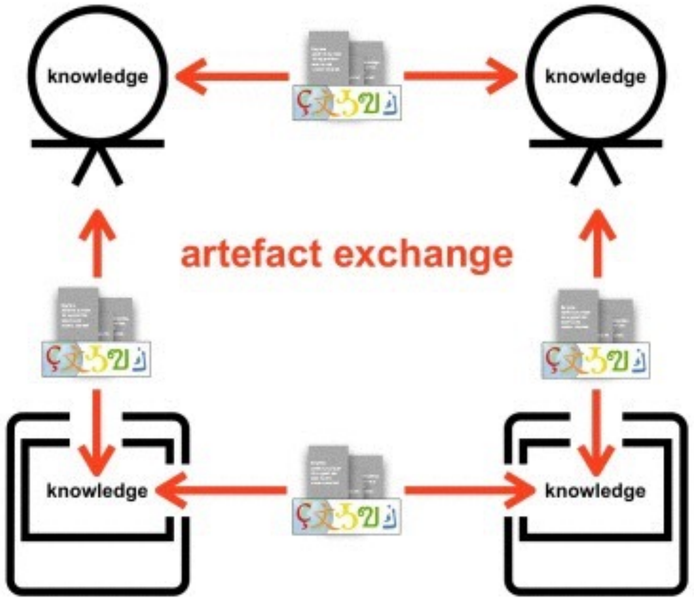
Tapping into the **visual processing capacity** of the human brain

The brain’s capacity for processing visual data is around 20 times higher than the brain’s capacity for processing audio data.

Even with simple technologies such as whiteboards and markers it is possible to design and use highly expressive and unambiguous visual languages that are much easier for humans to parse and understand than information in a linear format (audio or text).

MODA+MODE therefore makes extensive use of visual languages and provides guidance for developing further domain specific visual languages.

Developing better **languages and interaction styles**



In an increasingly software and data intensive human world the objective of human scale computing is to

improve communication and collaboration:

1. **between humans,**
2. **between humans and software systems,**
3. **and between software systems.**

This objective is another way of stating the goal of developing a language that is better than all human languages reliant on linear syntax.

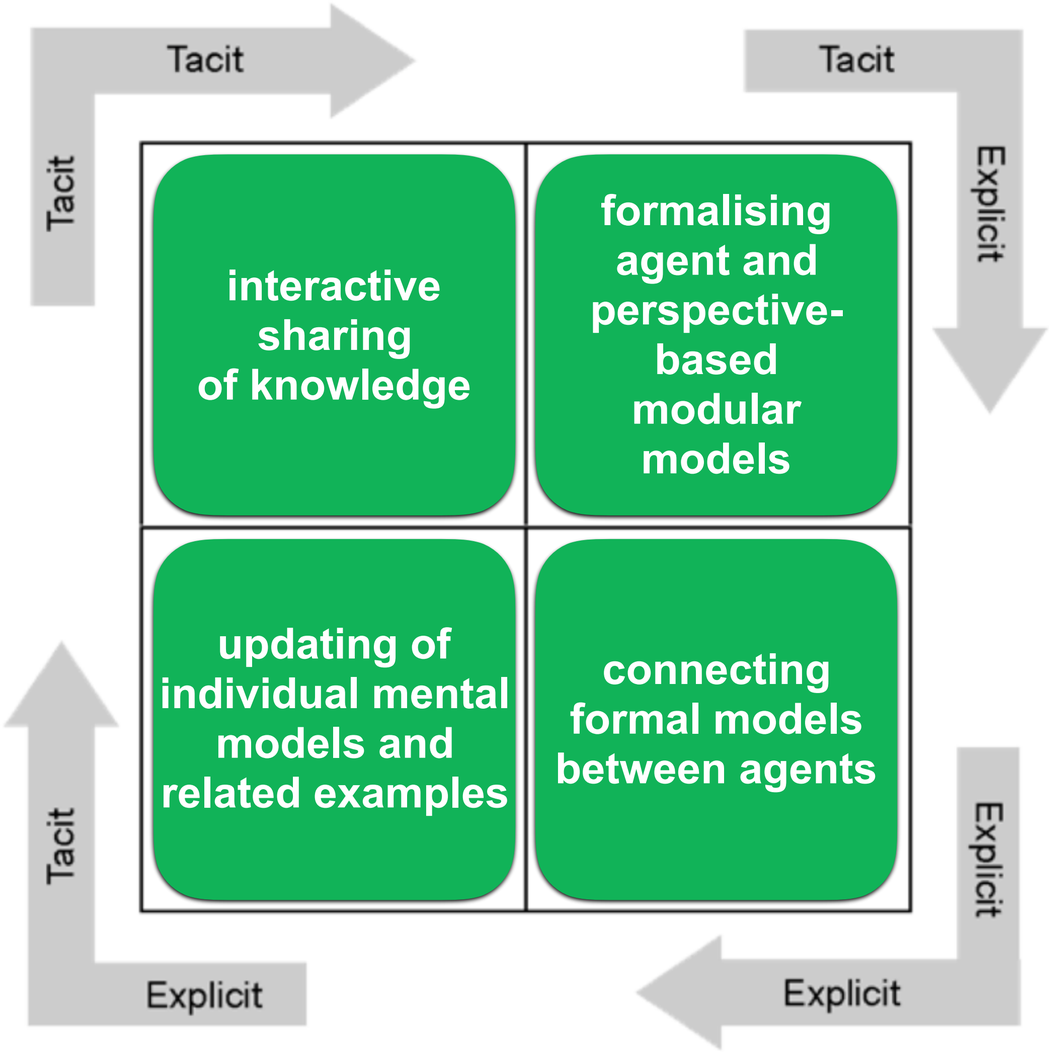
MODA + MODE backbone principles for **creating learning organisations and understandable systems**

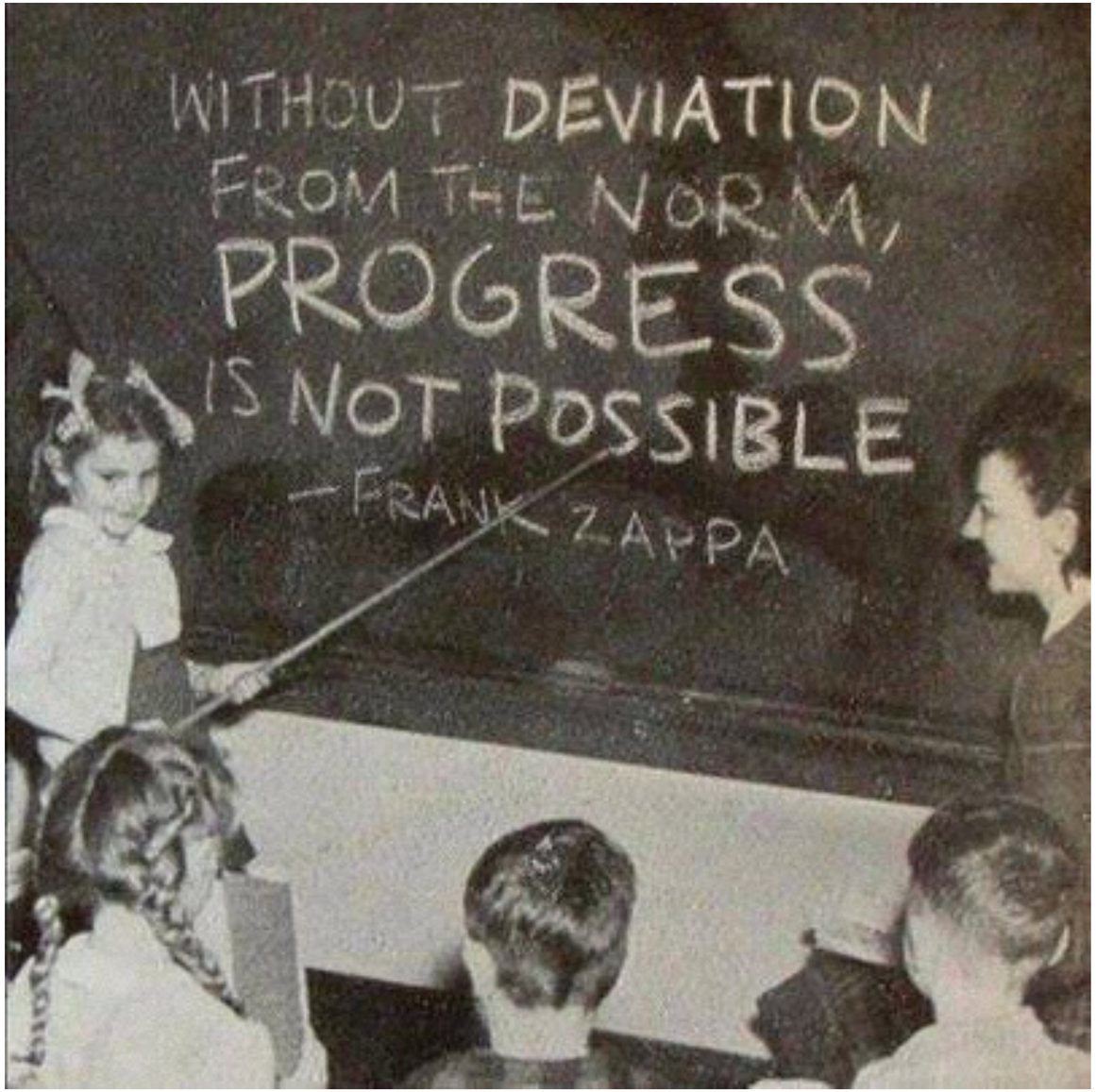
26 principles that provide
a meta paradigm to avoid
getting entrapped in a paradigm

MODA + MODE thinking tools for interdisciplinary research, design, and engineering:
https://coininco.files.wordpress.com/2017/08/moda-and-mode-lenses-and-principles.pdf

Creating **a learning organisation / system**

- The SECI model (*socialisation, externalisation, combination, internalisation*) is a useful conceptual tool for organising and structuring new service / product development, and for **extending the concept of continuous improvement into the realm of digital business and knowledge-intensive processes**
- MODA + MODE uses formal conceptual models to represent explicit knowledge
- Takeuchi, Nonaka, The New Product Development Game, https://hbr.org/1986/01/the-new-new-product-development-game , 1986
- Nonaka, Toyama, Hirata, Managing Flow: A Process Theory of the Knowledge-Based Firm, Palgrave Macmillan, 2008





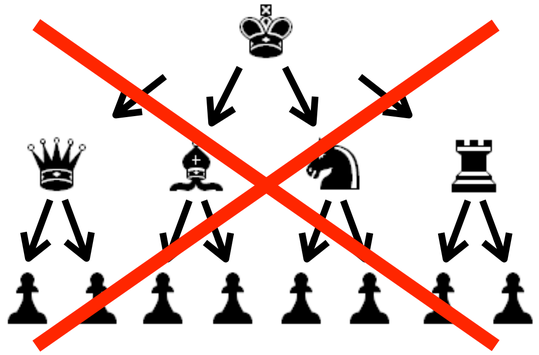
The learning capability of a project team is significantly shaped by

1. **the level of neurodiversity within the team**
2. **the way in which diversity is accommodated in the principles for collaboration**

Improvements and innovation

All effective approaches for continuous improvement (such as *Kaizen, Toyota Production System, Waigaya*, …) and innovation (*Open Space, collaborative design*, …) share one common principle.

In order to successfully identify and implement opportunities for improvement and innovation the belief in the existence and relevance of social hierarchies must be suspended



Why is this the case? What does this tell us about society?

The effect of hierarchical structures on innovation

1. Any form of hierarchy indicates a dampened feedback loop.
2. Power is the privilege of not needing to learn.
3. **A hierarchical organisation is the anti-thesis of a learning organisation.**

A simple advice process **creates** a **learning organisation**

Before making a major decision that affects others in the organisation

1. **A person has to seek advice** from at least one trusted colleague with potentially relevant or complementary knowledge or expertise.
2. **Giving advice is optional**. It is okay to admit lack of expertise. This enables the requestor to proceed on the basis of the available evidence.
3. **Following advice is optional.** The requestor may ignore advice if she/he believes that all things considered there is a better approach or solution. Not receiving advice in a timely manner is deemed equivalent to no relevant advice being available within the organisation. This allows everyone to balance available wisdom with first hand learning and risk taking.
4. **A few simple prosocial design principles provide guidance for dealing with people who regularly** ignore relevant advice (or consistently refuse to seek or give advice) and therefore regularly **cause downstream problems for others** as a result. Such situations are obvious for all involved. A persistent breakdown of collaboration either results in a significant change in behaviour once the downstream problems are recognised, or in the non-cooperative person leaving the organisation.

More information: Frederic Laloux, page 22 in *Reinventing Organisations* http://www.reinventingorganizations.com/

Prosocial core design principles

Applying evolutionary science to coordinate action, avoid disruptive behaviours among group members, and cultivate appropriate relationships with other groups in a multi-group ecosystem (the work of Elinor Ostrom, Michael Cox and David Sloan Wilson)

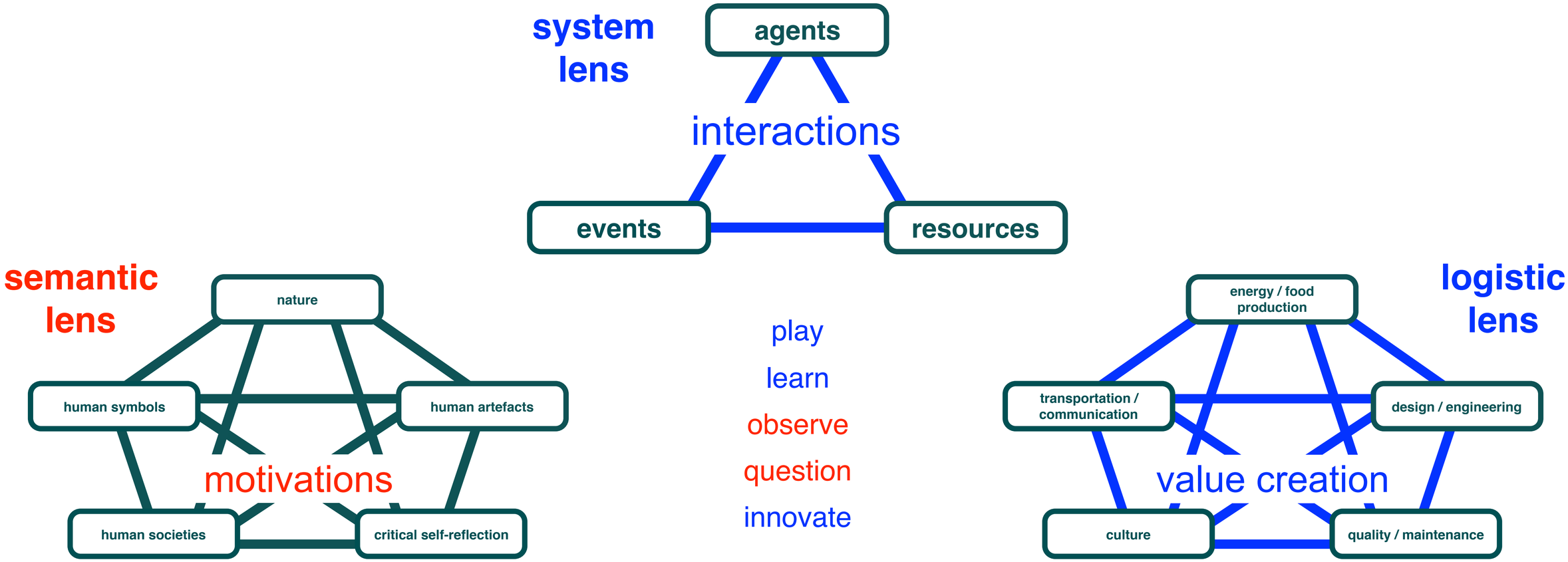
Core Design Principles:

1. **Strong group identity and understanding of purpose**
2. **Fair distribution of costs and benefits**
3. **Fair and inclusive decision-making**
4. **Fast and empathetic conflict resolution**
5. **Authority to self-govern**
6. **Appropriate relations with other groups**
7. Tracking agreed upon behaviours
8. Graduated responses to transgressions

A working **advice process** minimises the need for tracking

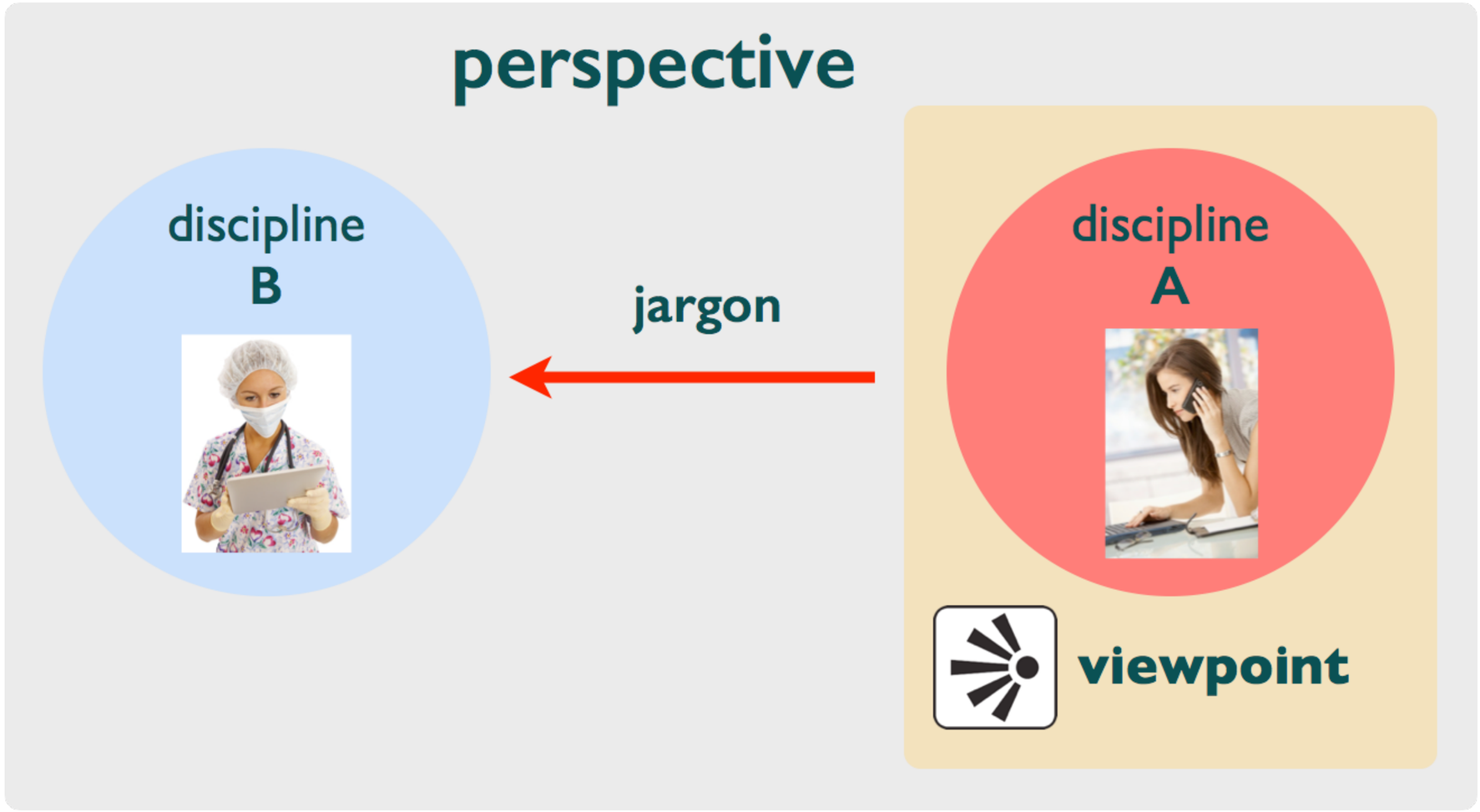
Fair and inclusive distribution of resources minimises the need for coercion

The **human lens** defines **categories that are invariant across cultures, space, and time**

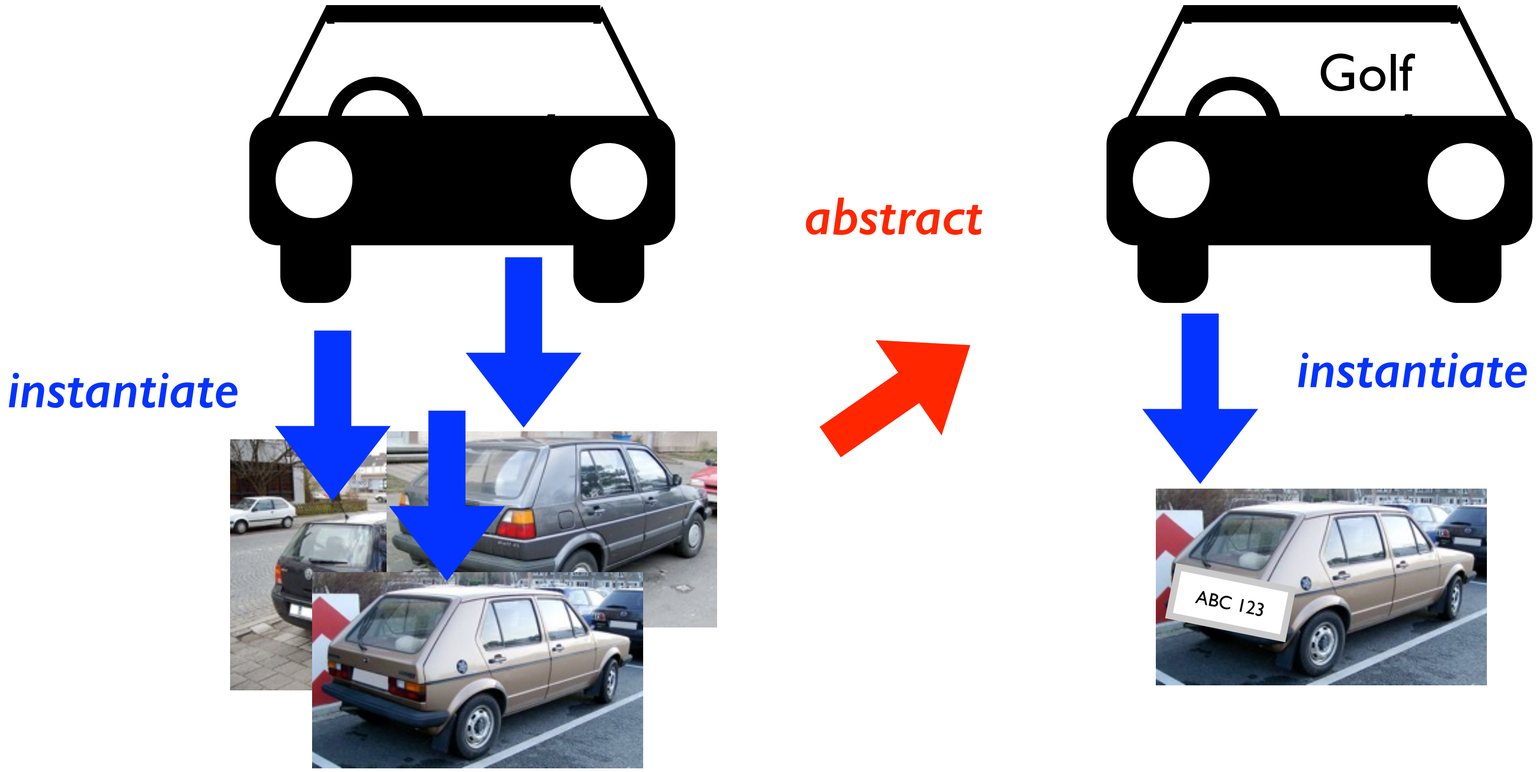


The MODA + MODE human lens and its invariant characteristics offer concrete guidance for designing visual domain specific languages (VDSLs) and for integrating VDSLs in a multi-agent and multi-perspective context.

Viewpoints and **perspectives**



Validation via instantiation (or “concretisation”)



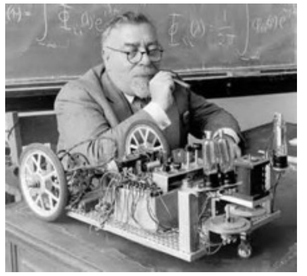
Observation: We need less **speculation** and much more **validation** via **instantiation !**

6 Questions

to surface tacit knowledge about systems

Investigating decision making processes that occur when applying knowledge:

- **When** and **how often** does a decision require revision? – **Events** and frequency
- **Who** arrives at the decision? – **Agents**
- **Why** is the decision made? – **Purpose** (which agents benefit?)
- **Where** (or in which **information artefact**) is the decision made? – **Location**
- **What** are the possible choices? – **Limits** of understanding
- **How** is the decision made? – **Heuristics**



Thank you!

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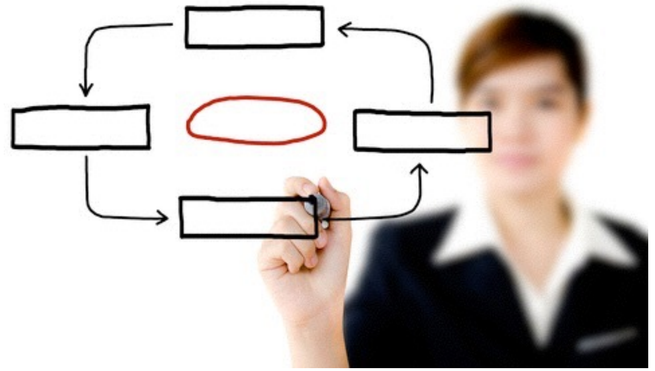
Nothing beats capturing the knowledge flow of leading domain experts to co-create organisations & systems that are understandable by future generations of humans & software tools.



Appendix

The MODA + MODE **backbone – principles 1 to 8**

#	MODA + MODE principle	motivations **critical self-reflection**	motivations **human societies**	motivations **human symbols**	motivations **human artefacts**	motivations **nature**
1	Understand that minorities and outsiders are well positioned for uncovering attempts of deception	addressing corruption	honesty			
2	Give minorities and outsiders access to private means of communication	development of new theories	equality			
3	Operate transparent governance	access to evidence	trust			
4	Adapt the cognitive load generated by technology to human cognitive limits	understandability	ease of communication, happiness	simplicity	usability	
5	Recognise neurological differences as authentic and valuable sources of innovative potential	discovery of externalities	resilience, happiness			resilience
6	Value metrics from the physical and biological world more than human opinions	minimise human bias	minimise cultural bias			
7	Value local perspectives more than widely-held popular beliefs	learning	collaboration between groups, happiness			
8	Value the strength of shared beliefs and corresponding evidence more than the number of shared beliefs	trust, happiness	trust, happiness			

The MODA + MODE **backbone – principles 9 to 20**

#	MODA + MODE principle	motivations critical self-reflection	motivations human societies	motivations human symbols	motivations human artefacts	motivations nature
9	Use information quality logic to minimise ambiguity		shared understanding, precision	quantification of knowledge		
10	Use probabilistic reasoning to acknowledge uncertainty		honesty, risk assessment	quantification of risk	quality management	
11	Conduct commonality and variability analysis		collaboration, simplicity, agility	simplicity	usability	
12	Formalise the results of commonality and variability analysis		shared understanding, resilience	sharing, automation	automation	
13	Develop visual domain specific languages to describe familiar domains in unambiguous terms		shared understanding, precision	simplicity, understandability	quality of design, manufacturing, recycling	
14	Understand that all information is dependent on perspective and viewpoint		diversity		usability, fitness for purpose	
15	Understand that a multitude of perspectives generates new insights		learning, resilience		innovation	
16	Validate shared understanding by sharing of models and corresponding instances		shared understanding, evidence		quality of design, manufacturing, recycling	
17	Understand that power gradients stand in the way of transformation		courage, transformation		reduction of externalities	
18	Aim for optimal conflict in a supportive and trusting team environment		agility, learning		quality of design, manufacturing, recycling	
19	Use agile experiments when venturing into unfamiliar domains to learn from mistakes		experiments, learning		quality of design, manufacturing, recycling	
20	Conduct an adequate number of experiments in different contexts to minimise risk before global application of major changes		caution		minimisation of externalities	

The MODA + MODE **backbone – principles 21 to 26**

#	MODA + MODE principle	motivations **critical self-reflection**	motivations **human societies**	motivations **human symbols**	motivations **human artefacts**	motivations **nature**
21	Understand that collaboration occurs to the extent that there is shared understanding		shared expectations		design of value cycles	evolution of ecosystems
22	Recognise paradoxes and disagreements as the essence of continuous improvement		evolution		continuous improvement of design, manufacturing, recycling	evolution
23	Practice everyday improvement, everybody improvement, everywhere improvement		continuous parallel evolution		continuous improvement of design, manufacturing, recycling	continuous parallel evolution
24	Engage in niche construction		diversity, resilience, happiness		resilience in design, manufacturing, recycling	biodiversity, resilience
25	Use feedback loops to create learning systems		learning systems		speed of innovation	codes, cell chemistry, recursion, neural networks
26	Use modular decentralised design to promote reuse without compromising resilience		simplicity, resilience		resilience in design, manufacturing, recycling	cells, organs, organisms, species, ecosystems

A culture may have further bones, but one or more
missing vertebrae severely compromise capability

Typical use cases in **industry**, **academia**, and **government**

The MODA + MODE approach has a fractal characteristic that enables it to operate at all levels of scale, with explicit support for feedback loops between different levels of scale:

- Development of collaboration platforms that improve the resilience and performance of **economic ecosystems**.
- Development of technology platforms that harness deep domain expertise to streamline the development of **new products**.
- Improvements in quality, reliability, and productivity of specific **teams** or **technological systems**.
- Integrating the knowledge of multiple domain experts in a cross-disciplinary context to co-create innovative **solution designs**.
- Translating tacit knowledge into **explicit knowledge** that does not decay over time.

Conference on Interdisciplinary Innovation and Collaboration

play, learn, observe, question, innovate

Challenges that Go Beyond the Established Framework of Research in Industry, Government and Academia

Scientists, Engineers, Entrepreneurs, Artists & Mathematicians

CIIC brings together academic researchers and practitioners every 3 months to tackle wicked problems that don't have an obvious solution.

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MODA + MODE is being integrated into the
curriculum on **entrepreneurial strategies**, **creative technologies**,
and **methodologies for trans-disciplinary research and collaboration**