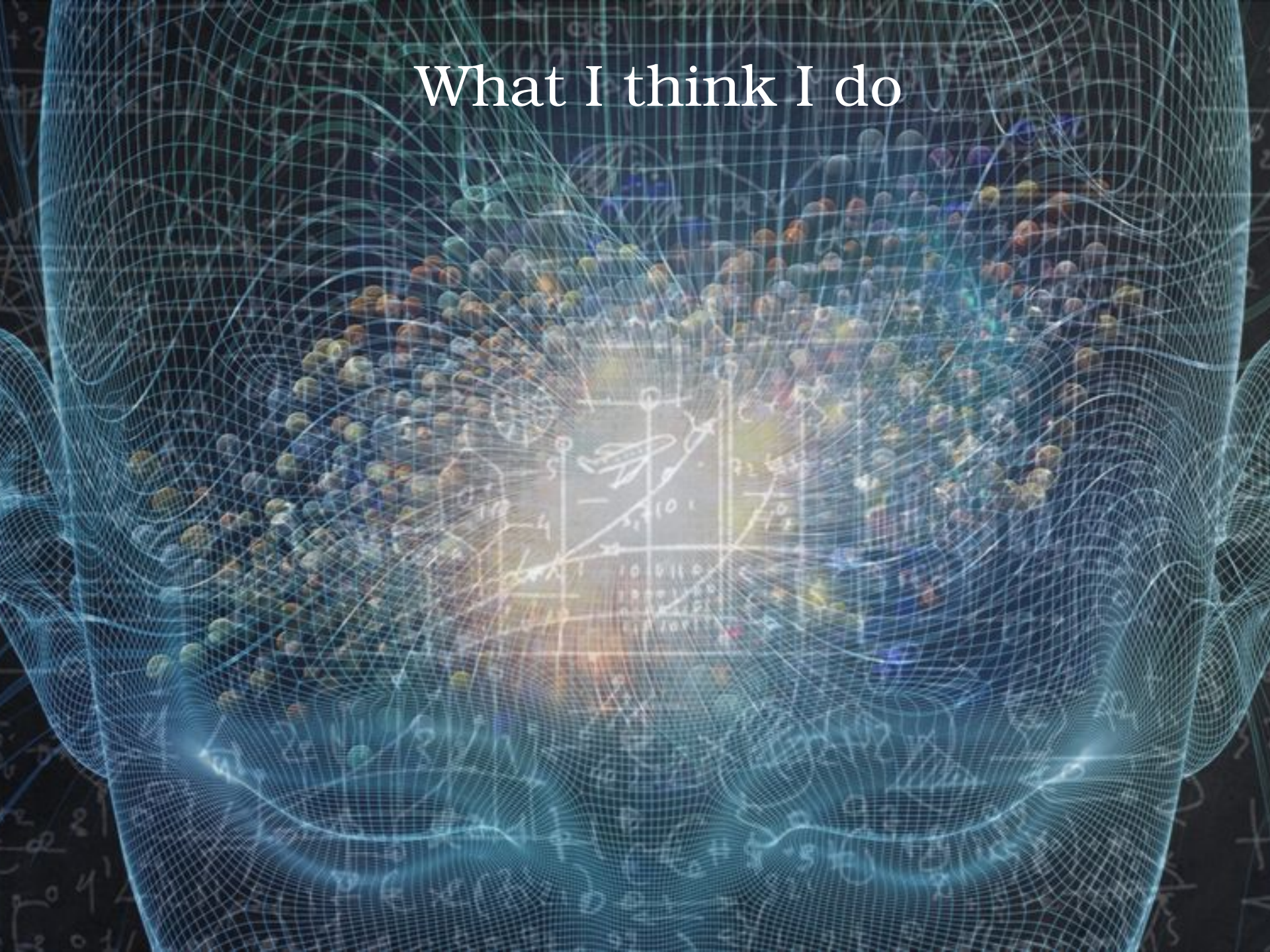


# Reflecting on complex modeling for decision support

Dr. ir. Igor Nikolic

What I think I do



What industry thinks I do





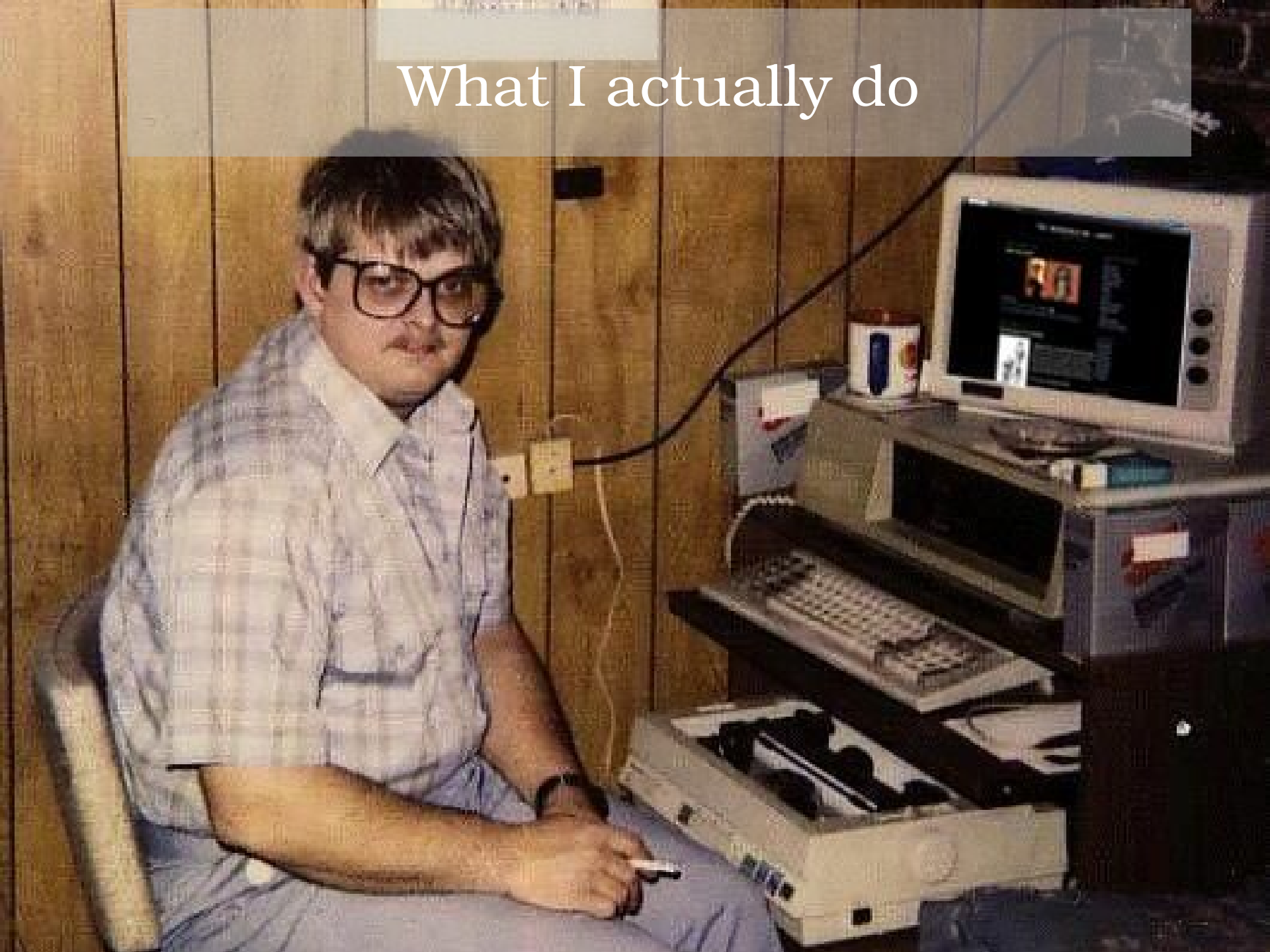
# What my wife thinks I do

Definition  
Internationalization - the process of gaining international context or relevance

Internationalization - the process of gaining international context or relevance



What I actually do







# Large scale socio-technical systems are Complex Adaptive Systems

- Many social and technical components (Huges 1987)
  - Parallel, distributed self organization with reflective downward causation (Holland 1996, Kroes 2009)
  - Evolve over time (Dennet 1996)
  - Require multiple formalisms to understand fully (Mikulecky 2001)
  - Are value and emotion loaded. (Roesser 2012, van der Hoeve, 2012)
- 
- Are embedded in, and have co-evolved with the planetary *bio-geo-chemical system*

# Why do we model ?

- Understand a system
- Predict a system
- Control a system
- Support a decision
- Agenda setting
- Understanding ourselves



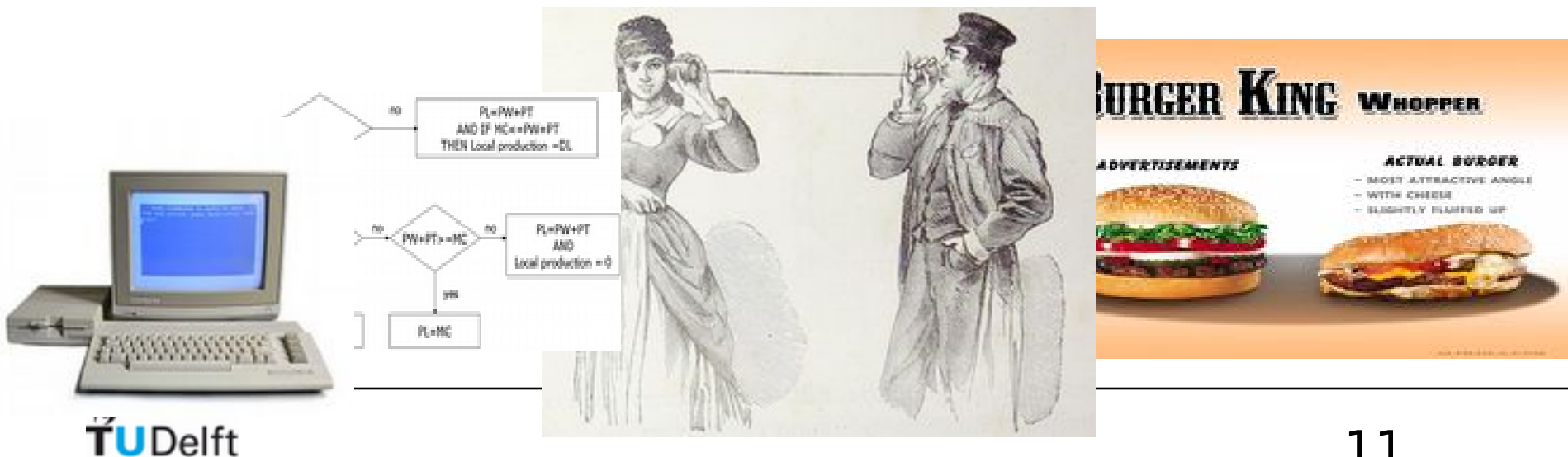
# 10 Propositions about modelling

# Model a problem, not a system

- Model a system: where to start & stop!?
- What matters, what does not?
- No objective way to determine, necessarily a subjective choice!

# Modelling is a social process

- A negotiated computer implementation of the conceptual formalization of the modellers understanding of the stakeholders understanding of the stakeholders understanding a part of reality
- Four steps removed from reality and socially constructed!





# Allow for requisite variety

“A model system or controller can only model or control something to the extent that it has sufficient internal variety to represent it.”

remember we are dealing with

- Socio-technical systems
- Parallel, distributed self organized
- That evolve
- Require multiple formalisms
- Are value and emotion loaded



W. Ross Ashby

# All models are wrong

• “All models are wrong, some are useful ! ”

• Every model is a simplification of reality.

• How to build the least wrong, most useful model?



George P.E. Box 2005

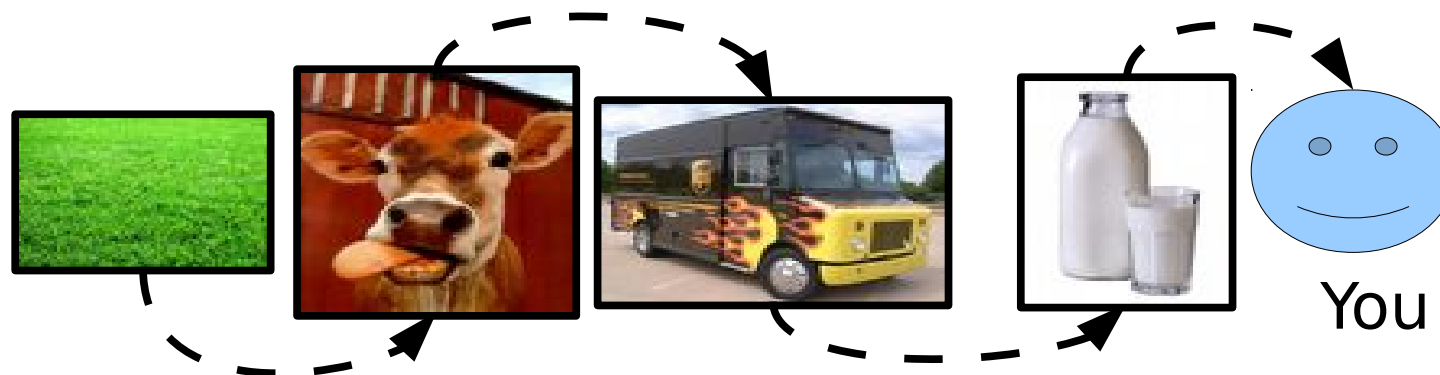
# Simplicity requires complexity

“Civilization advances by extending the number of important operations which we can perform without thinking about them.”

- “Just give me 7 KPIs” → massively complex models



Alfred N. Whitehead, 1911





# Galls law : Complexity must grow

A complex system that works is invariably found to have evolved from a simple system that worked.

A complex system designed from scratch never works and cannot be patched up to make it work. You have to start over with a working simple system.

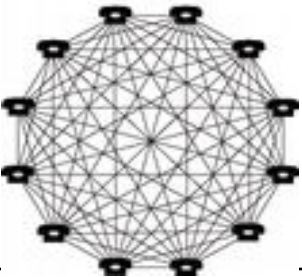
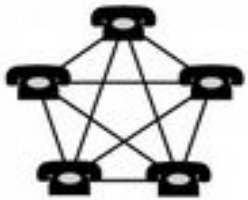


John Gall 1975

# Interconnectivity is exponentially useful

Value of a information network is proportional to the square of the number of connected users/elements of the system ( $n^2$ )

Your insight rises exponentially with the number of models you can interconnect



Robert Metcalfe 2003

# Goal is insight, not numbers

- Getting numbers are easy, getting insight is hard
  - A model will always give you a number...

Corollary to this :

- Usefulness of a model is measured by the speed by which it is replaced



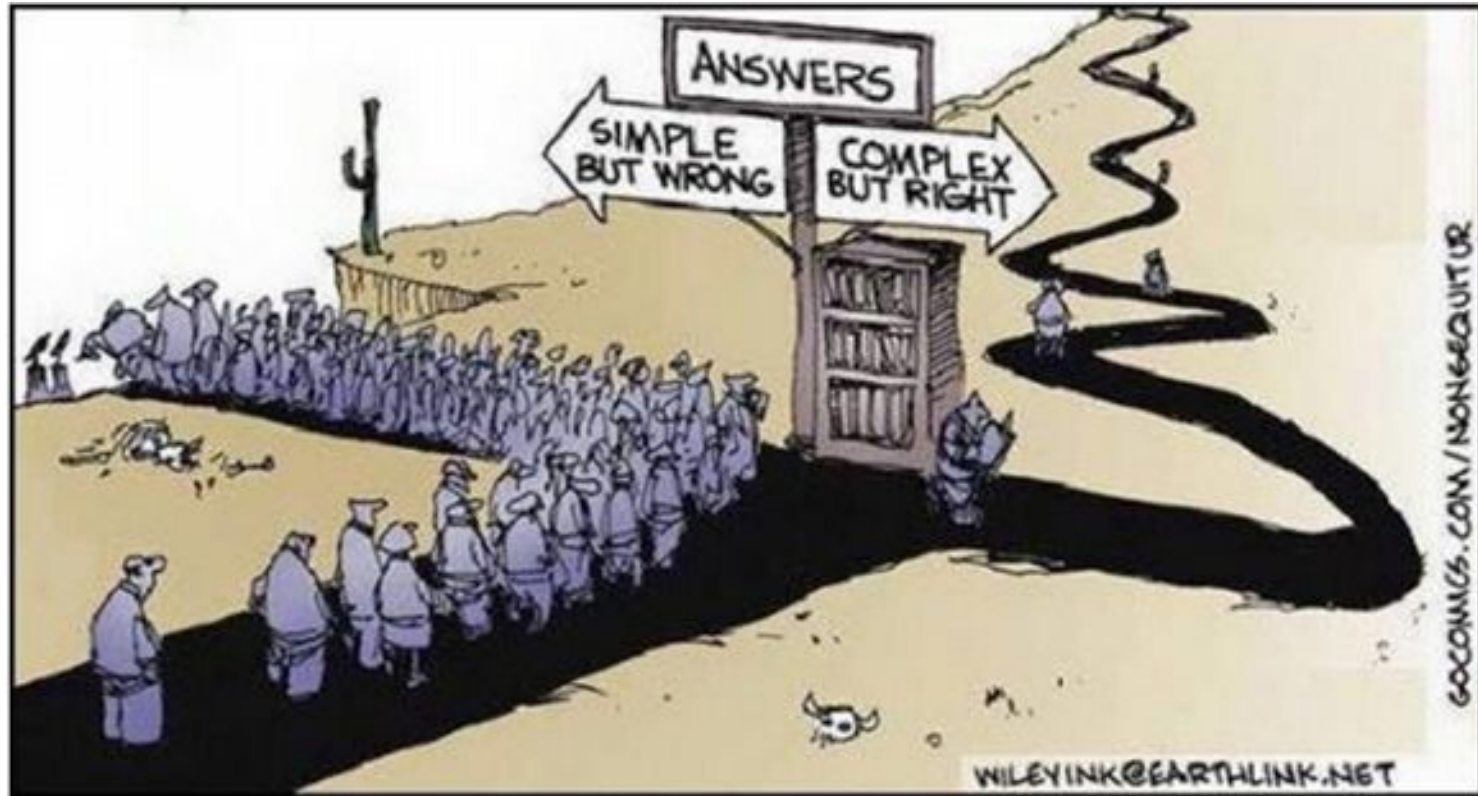
# Models are like like drugs

- Mind-altering and enlightening if used correctly
- Addictive and damaging if not
- Produce pretty pictures that cloud the mind
  - Pretty or desirable is not the same as true
- Are tools and not crutches
  - Can never replace reasoning and critical thinking

# Propositions about modelling

- Model a problem, not a system
- Modelling is a social process
- Allow for requisite variety
- All models are wrong
- Simple answers require complex models
- Grow into complexity
- Interoperable tools are exponentially more useful
- Goal of modelling is insight, not numbers
- Models are like drugs

# Thank you!



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