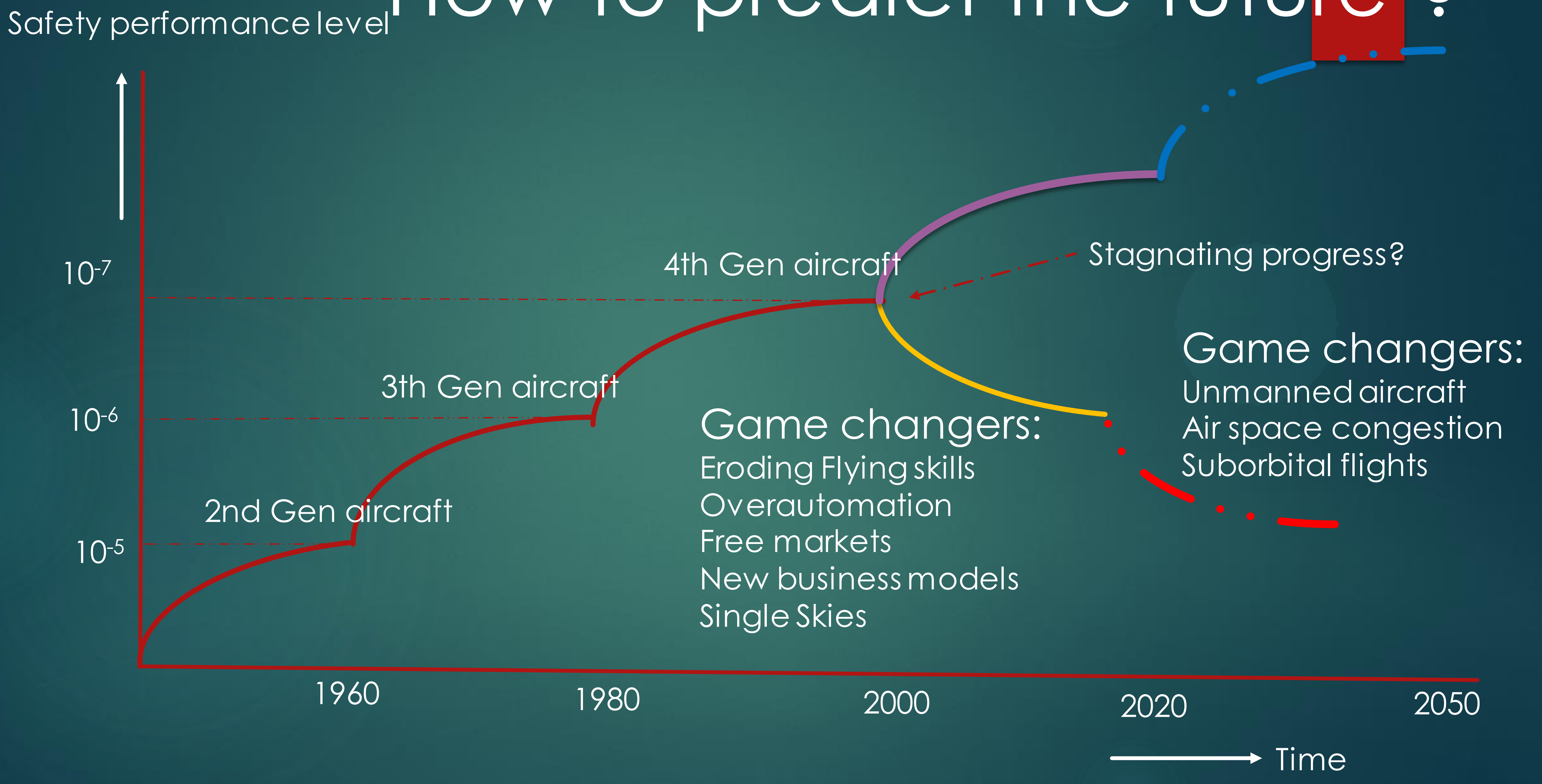
KIVI bijeenkomst 30 Nov 2018

LANGE TERMIJN ONTWIKKELINGEN IN RISICOBEHEER:

RESILIENCE EN AGEING

JOHN STOOP

How to predict the future ?



Safety: Schools of Thought

1. Tort Law

   engineering, education and enforcement

   railway, automobile, aviation industry

2. Reliability engineering

   maintenance, PRA, human factors, HRO

   high- tech industries

3. System safety engineering

   life cycle analysis, certification, impact assessment, governance, disaster and emergency management

A new School of Thought

Safety Deficiencies and System Change

mission statement:
independence, no blame
timely transparency on factual functioning
primary processes in socio-technical systems
starting with technology and fact-finding
including organization, institutions and context
expanding towards all modes and sectors

Serving two masters

1. Efficiency, systems engineering fundamentals:

- First Time Right, Zero Defects
- The need for a systems leap in systems performance

2. Legitimacy, societal demands due to:

- Shift in acceptance and perception of safety and risk
- Independent Investigations; a Citizens' Right and Society's Duty

Towards a 5th school of thinking?

Not only
- technological products but also
- decision making processes and
- organisational and institutional arrangements

Objectives:

- Upgrading towards a timely transparency in factual functioning of socio-technical systems
- Shifting from technical/physical intervention towards transparency in engineering design and decision making
- Supporting the safety assessment of engineering design and decision making processes
- Proactive focus, also adressing ethical design issues
- Expansion towards the public domain and other sectors

Modern technology in context

- Towards socio-technical systems
- And the role of safety assessment

- Cutting edge technology
- In an open, social and institutional environment

- Systems leaps/technological innovation
- Increasing societal demands and constraints

- Safety in a societal context: governance, sustainable, circular economy
- Safety in an industrial context: product, process, occupational, crisis management

Decision making in context

state of the art:

adequate instruments or metaphors and myths?

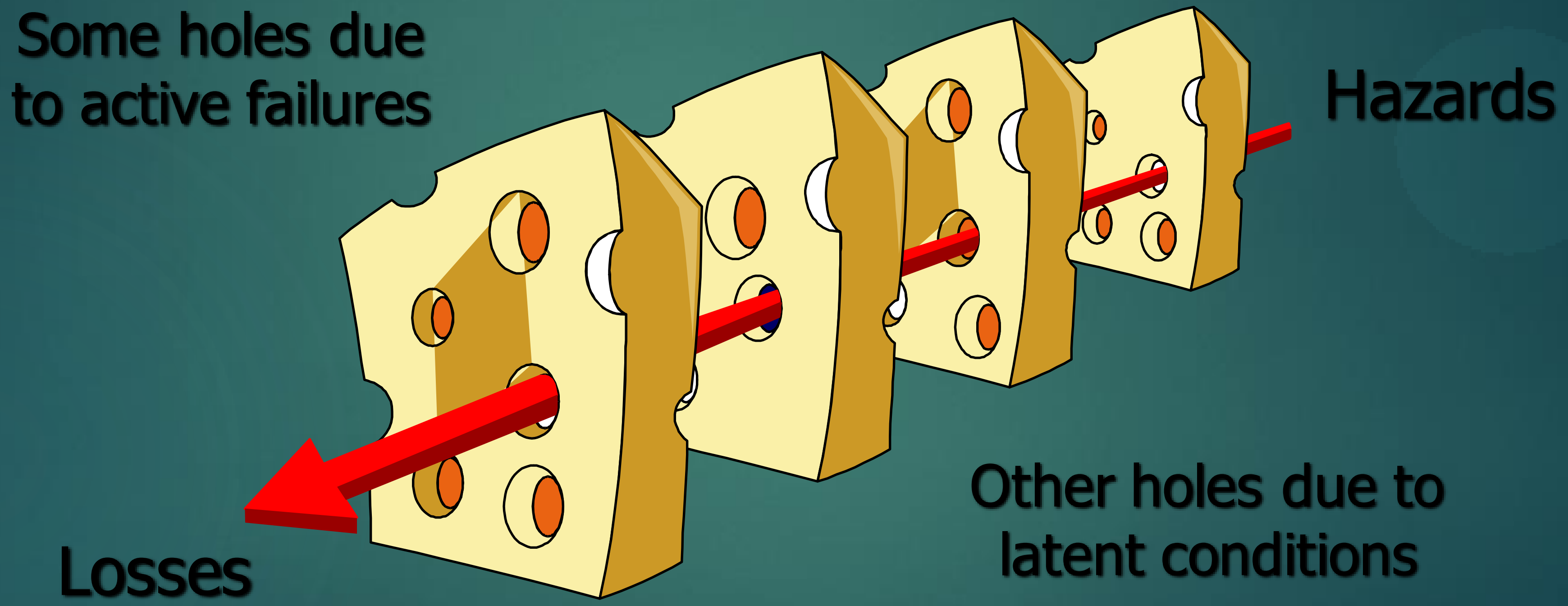
James Reasons' estimates of human error

(as a per cent of all failures)

Jet transport	65-85
Air traffic control	90
Maritime vessels	80-85
Chemical industry	80-90
Nuclear power plants (US)	70
Road transportation	85

Human performance problems dominate the risks in hazardous industries.

The 'Swiss cheese' model of organizational accidents



Successive layers of defences, barriers, & safeguards

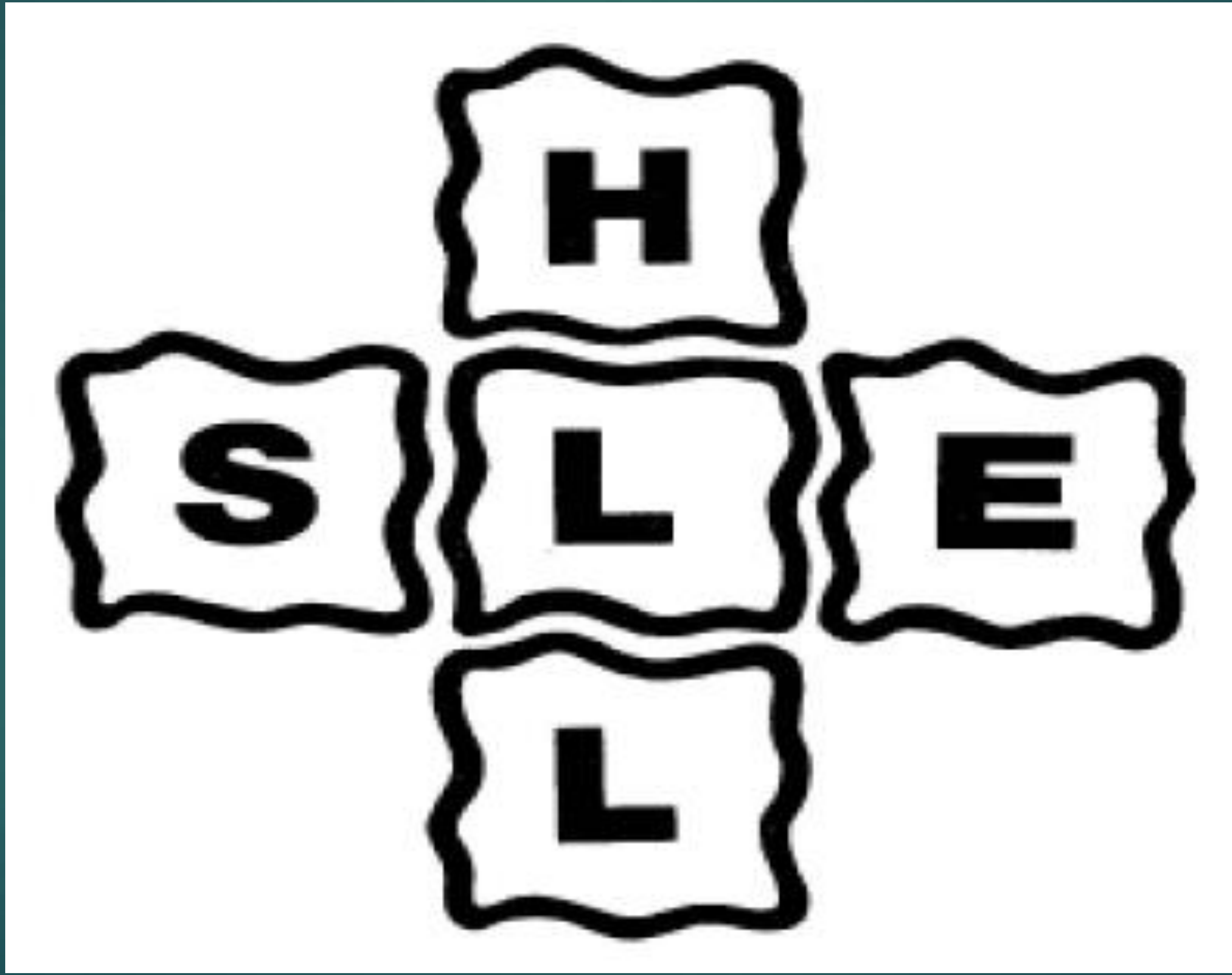
Remote factors: some concerns

- They have little causal specificity.
- They are outside the control of system managers, and mostly intractable.
- Their impact is shared by many systems.
- The more exhaustive the inquiry, the more likely it is to identify remote factors.
- Their presence does not discriminate between normal states and accidents; only more proximal factors do that.

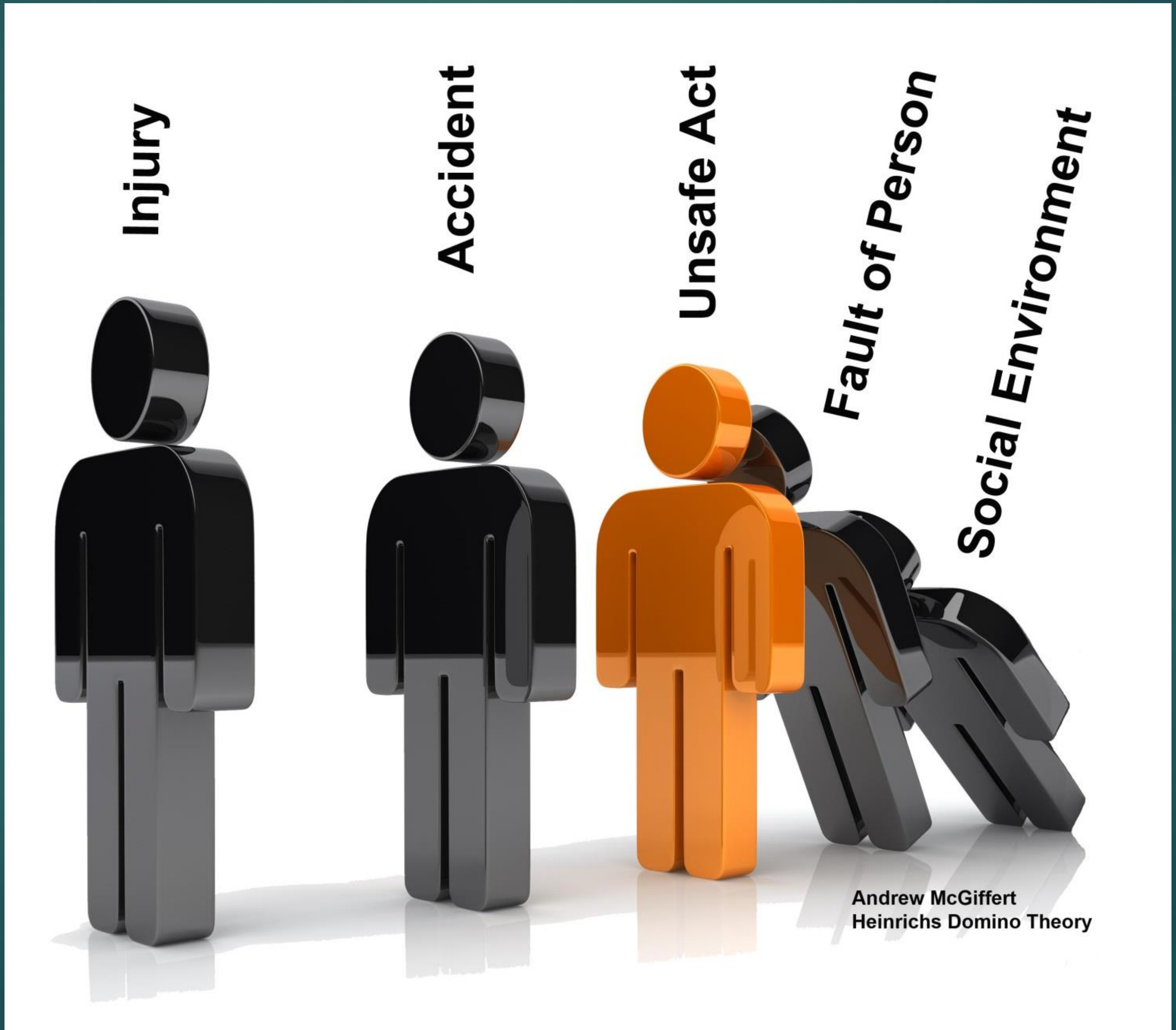
Going to extremes

- Legasov on Chernobyl: a failure of the Soviet economy.
- Moshansky on the Dryden accident: a failure of the Canadian air transportation system as a whole.
- Gehlen on *Columbia*: causal roots of the accident can be traced to the turbulent post-Cold War policy environment prevailing between *Challenger* & *Columbia* accidents.

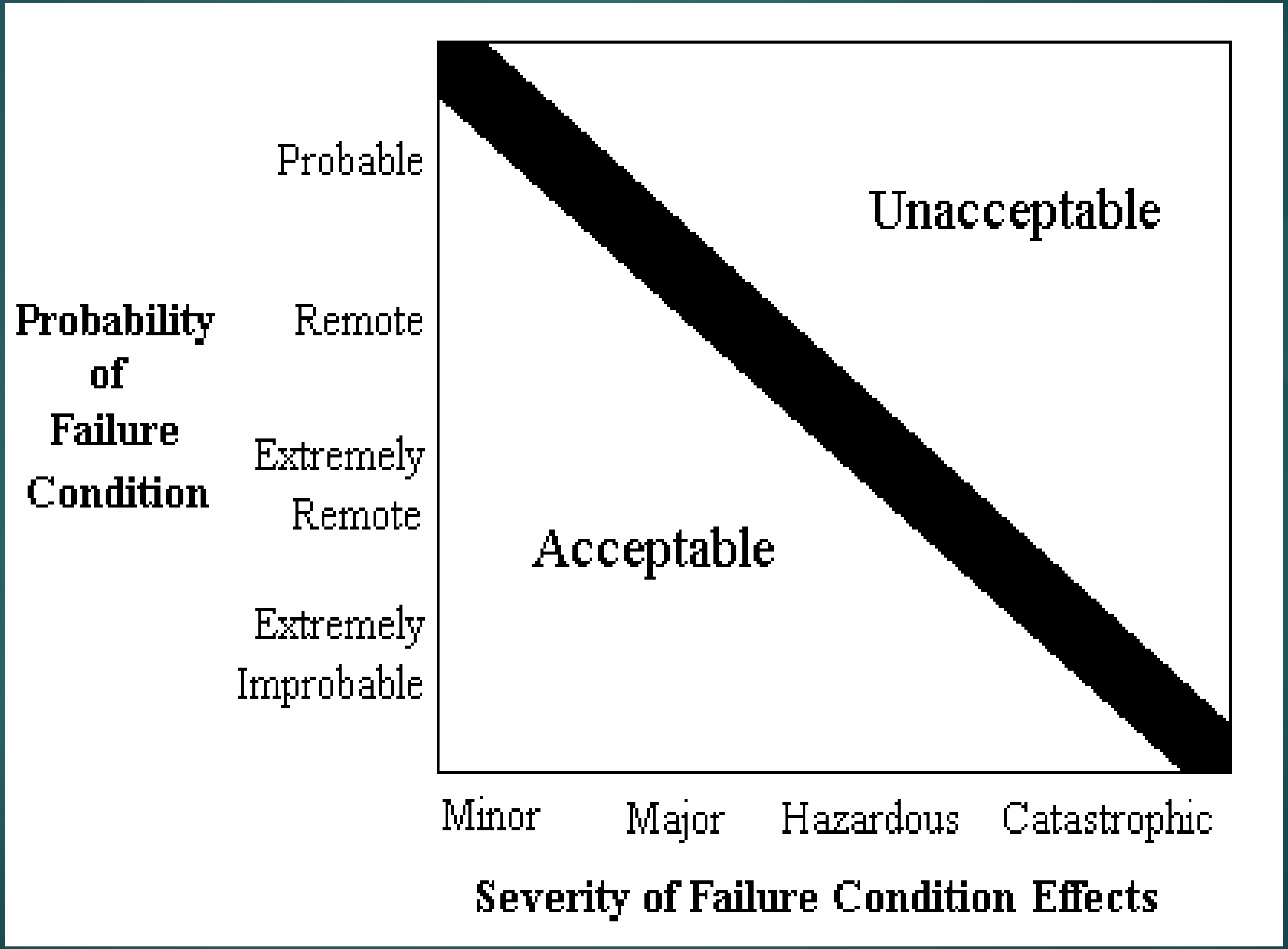
Simplistic systems modelling



Linear causational chains

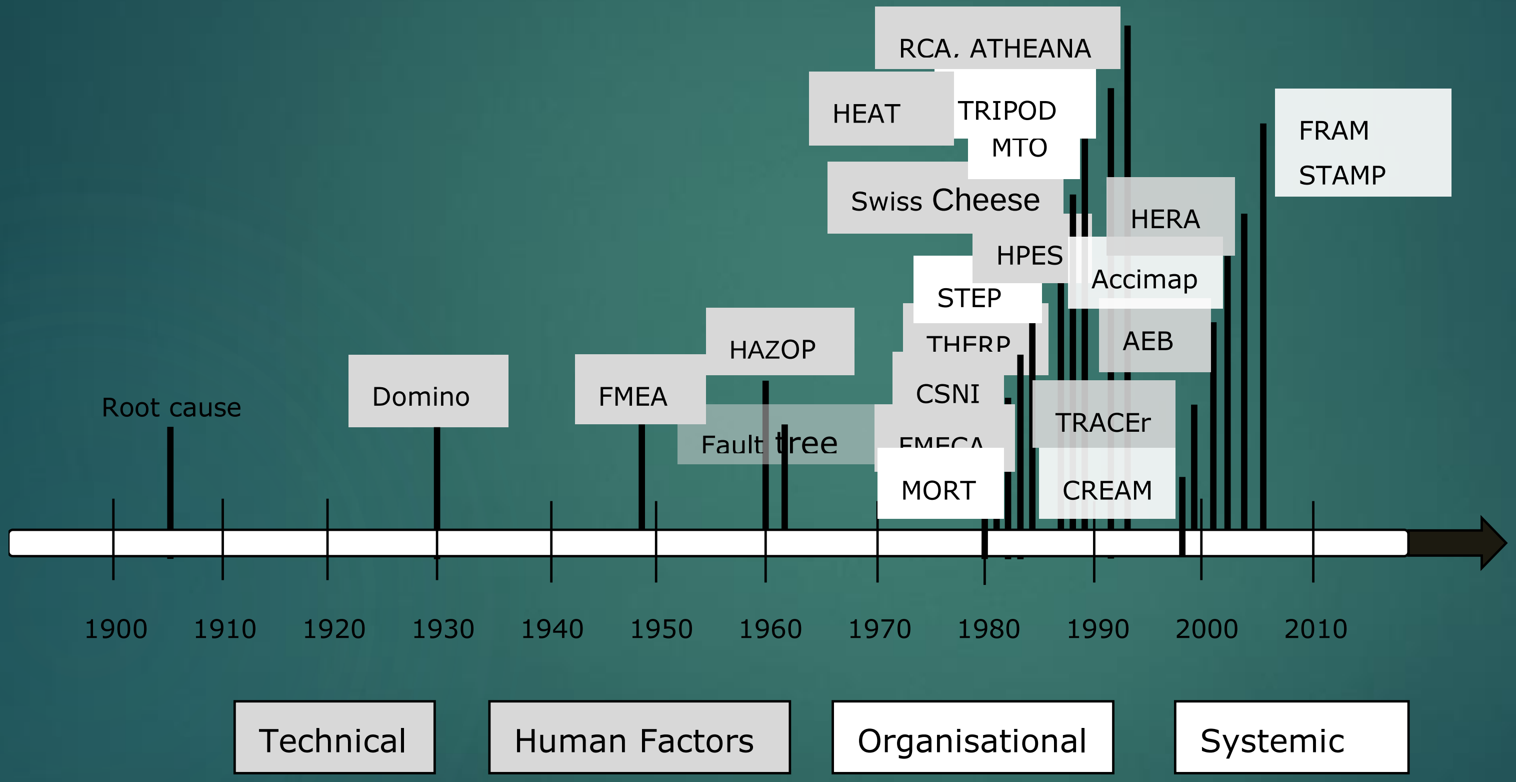


One dimensional decision making



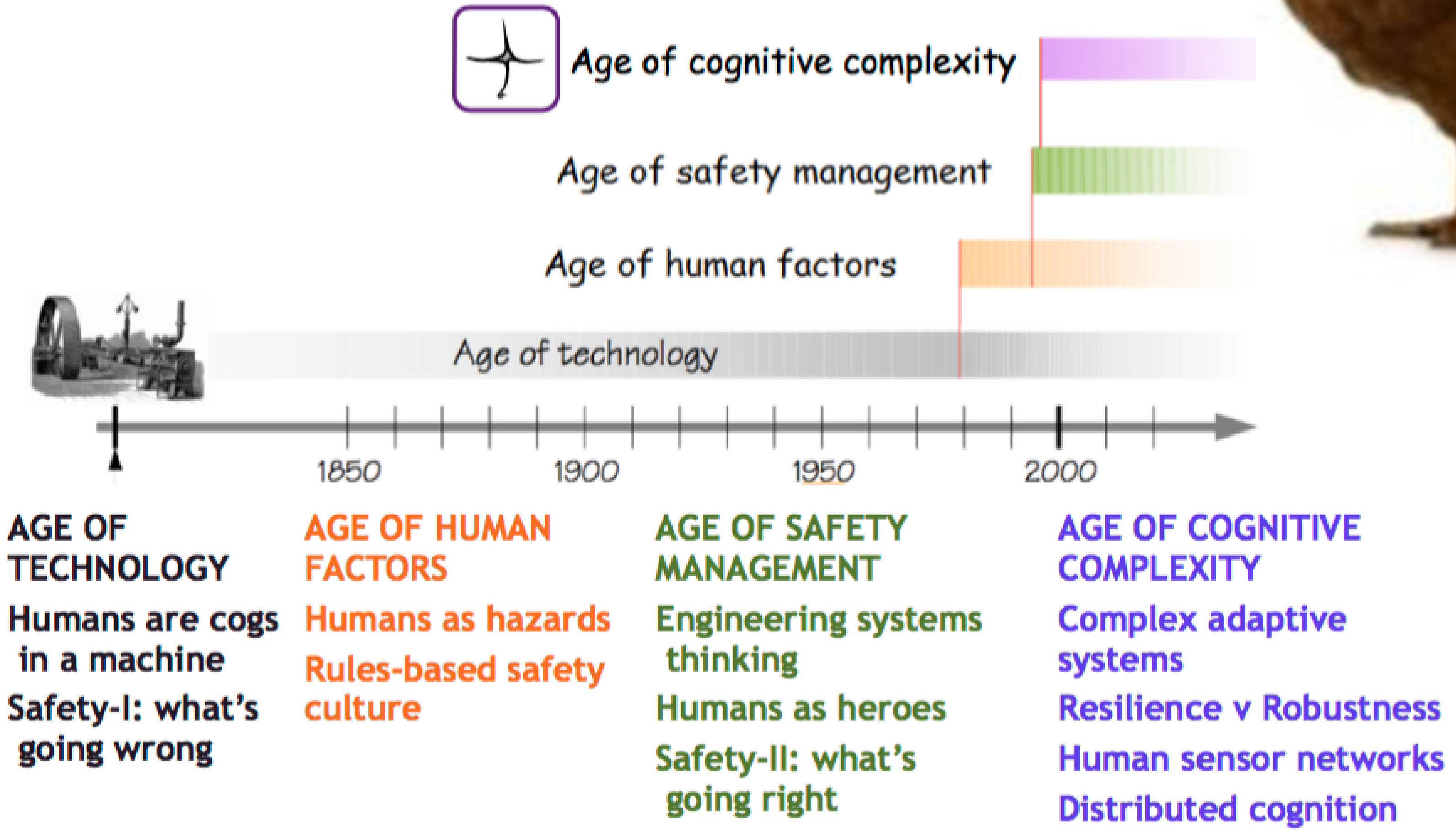

No more cheese please

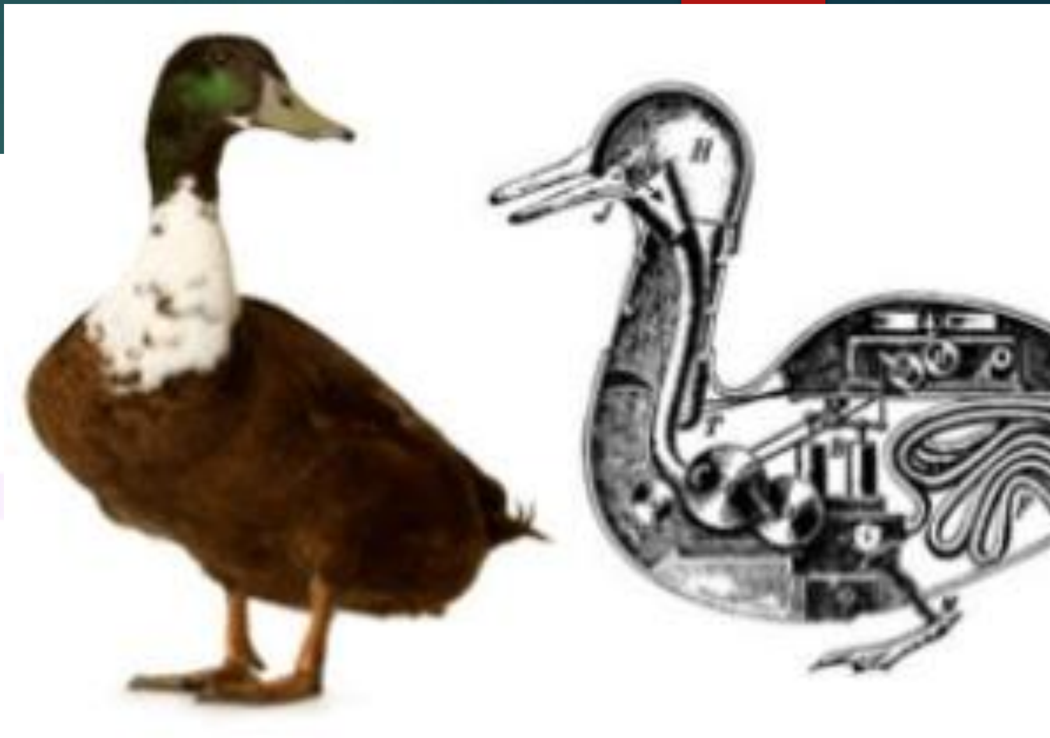
Expanding scala of accident models: one, two, many?



Analyse methoden Bron: Erik Hollnagel, 2008 (Mines ParisTech)

Succession of perspecti





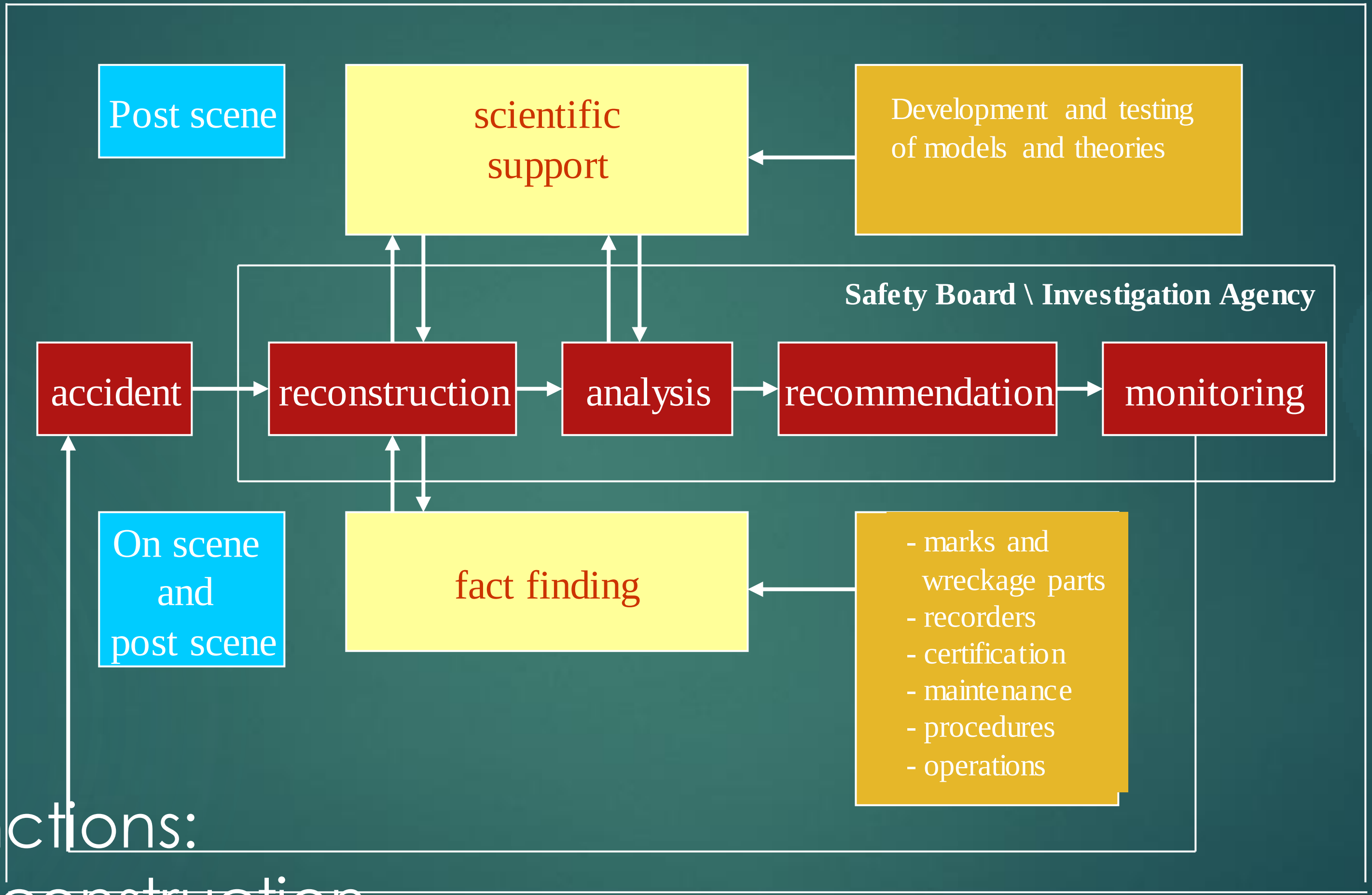
Perfect modelling ?

Specifics and context dependent

System properties	tractable	intractable
stable	robust	redundant
instable	reliable	resilient

Safety Boards: a process approach

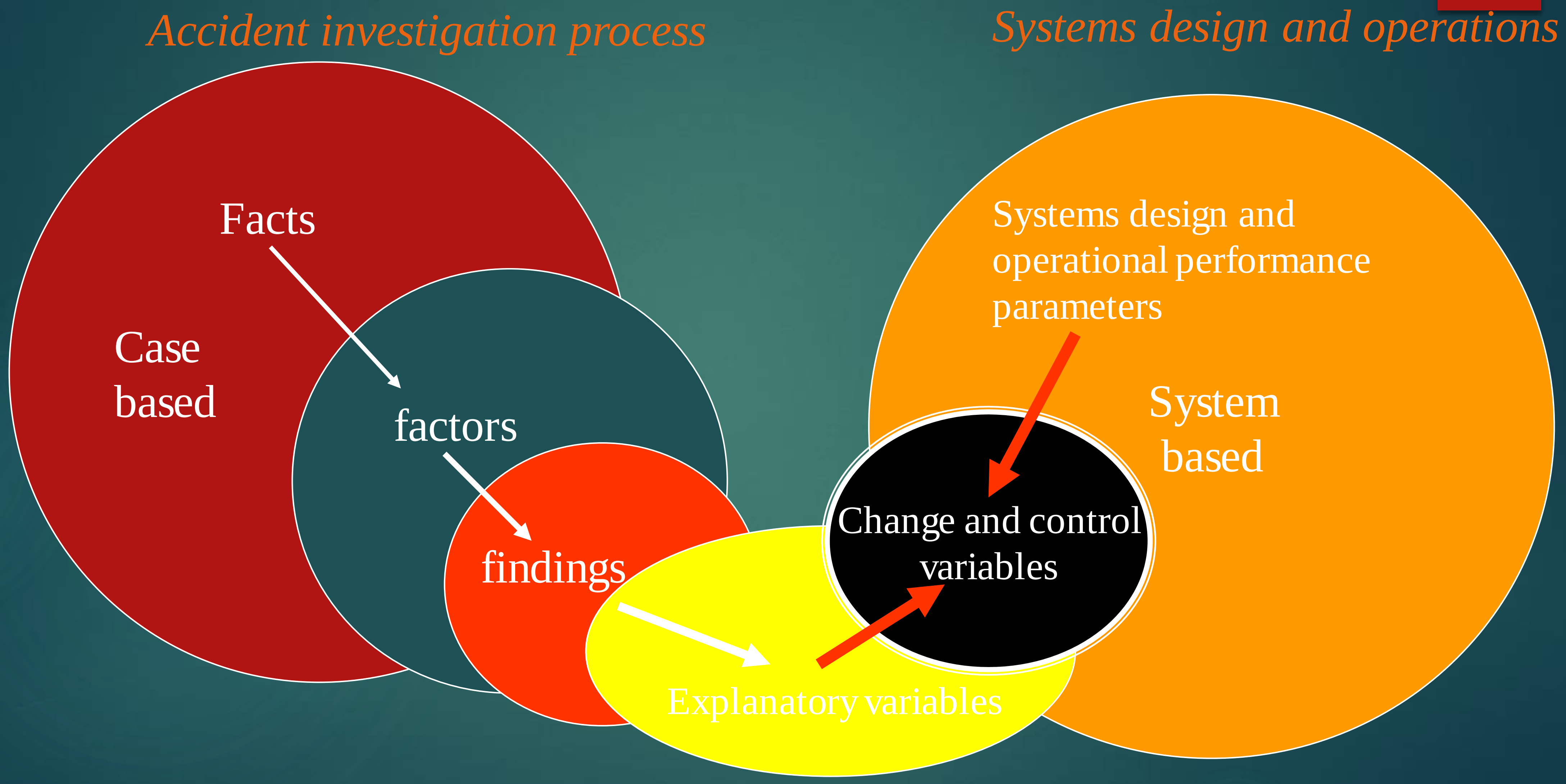
Safety Boards: Problem providers for knowledge developers



Three primary functions:

- Investigative reconstruction
- Analytic interpretation
- Adaptive intervention

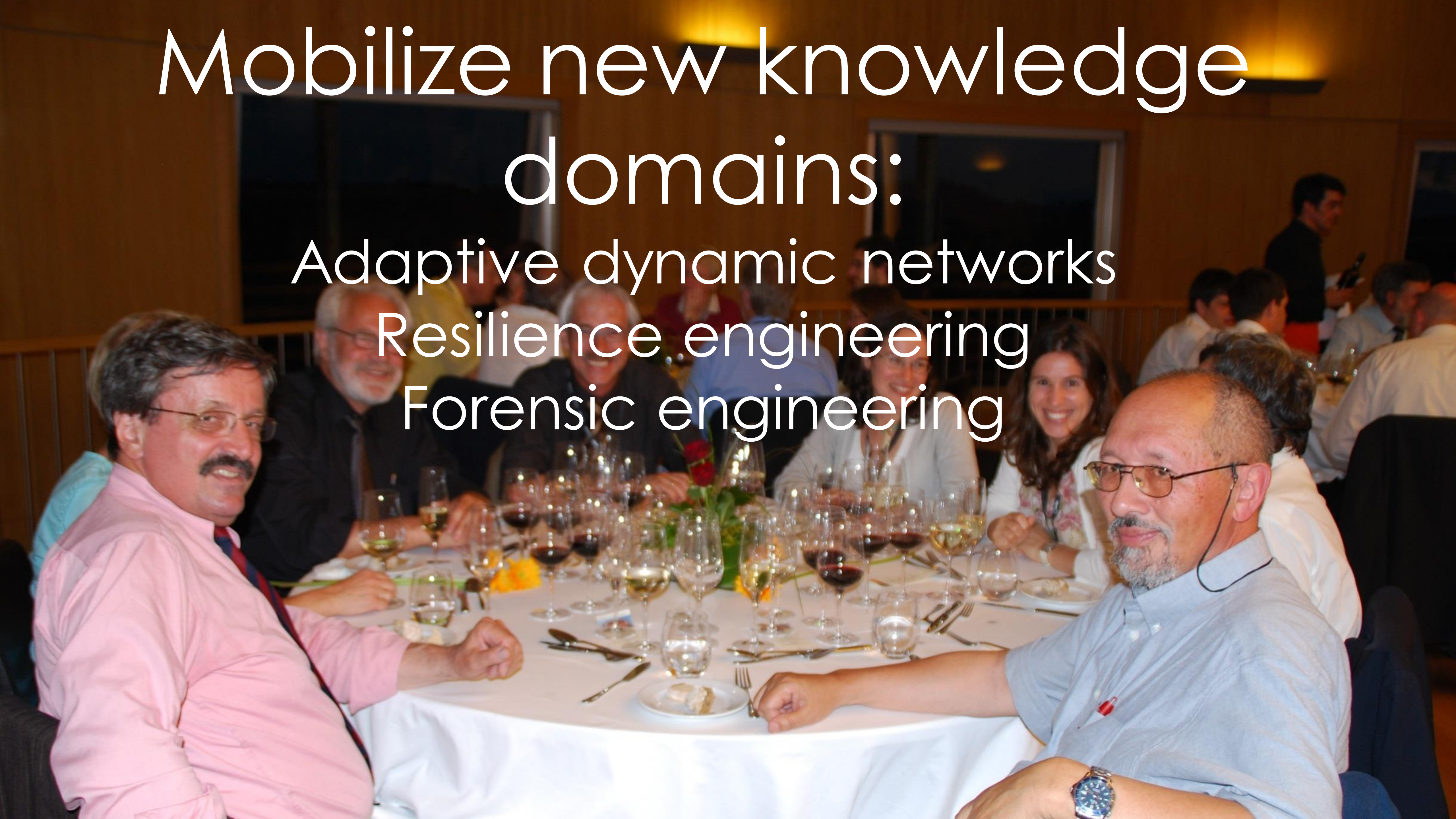
Transition from explanatory to control and change variables



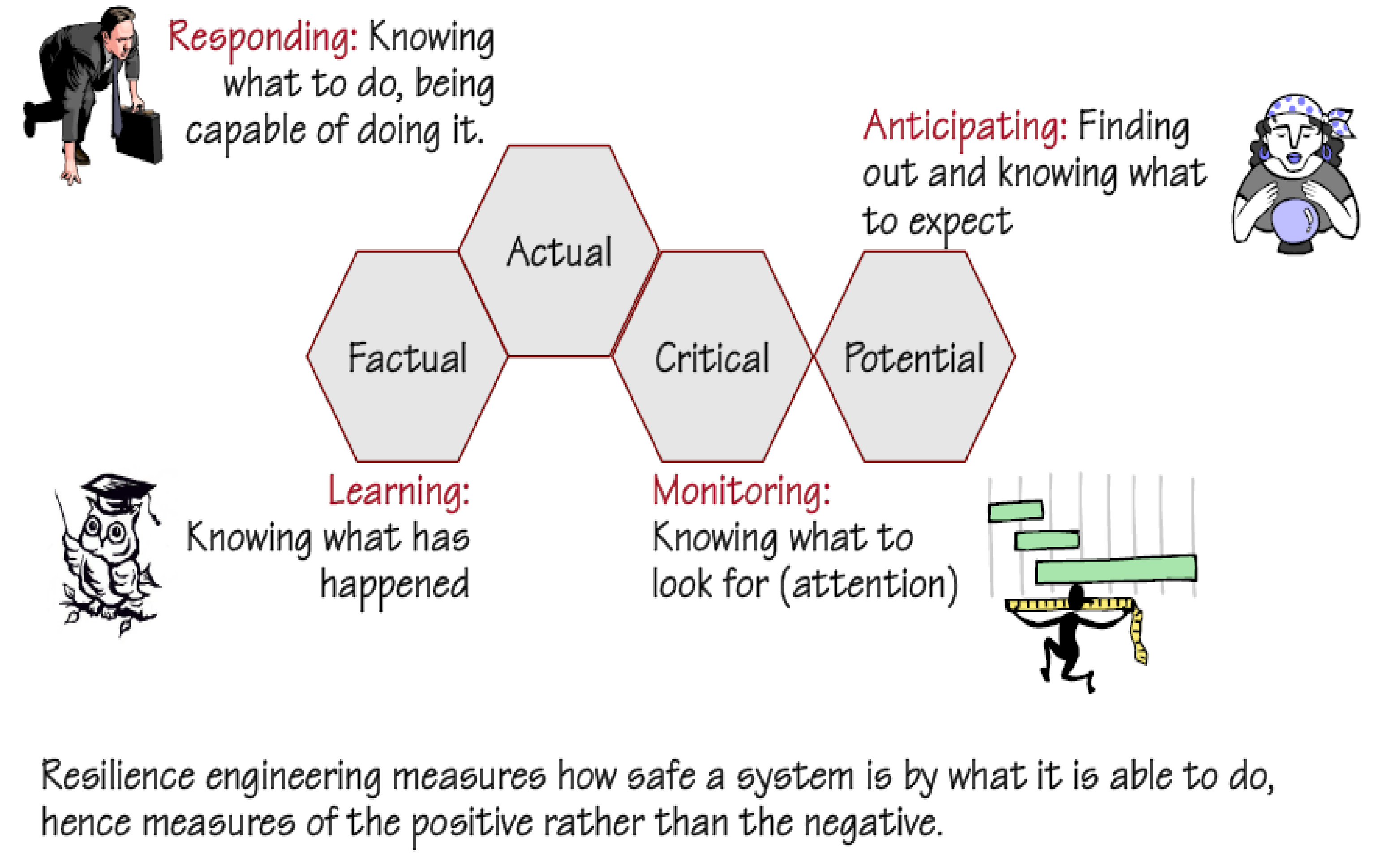
Discriminate between event and system

Mobilize new knowledge domains:

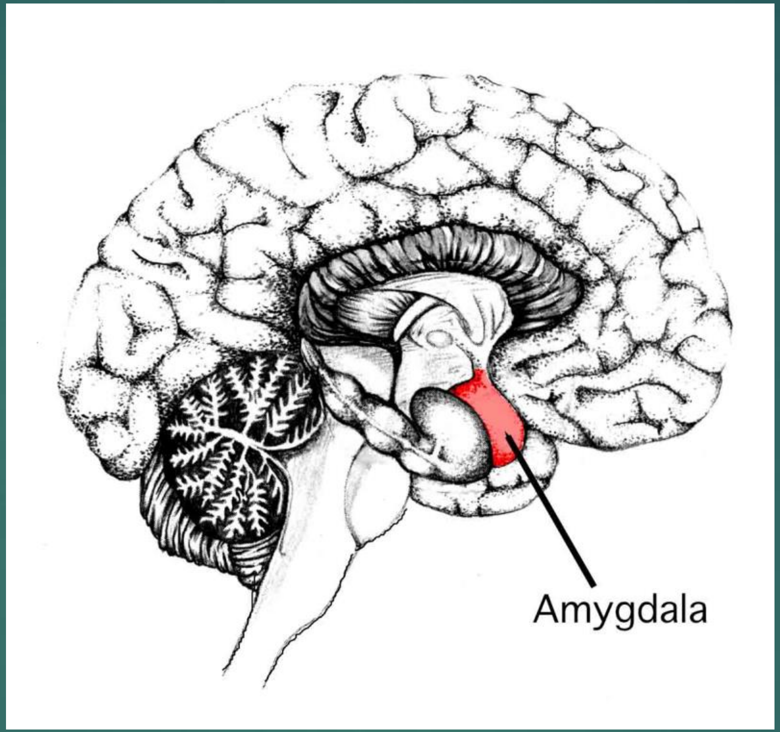
- Adaptive dynamic networks
- Resilience engineering
- Forensic engineering



NEW safety concepts:
- resilient risk management
- Safety 1 And Safety 2



Focus on brain functions



Hippocampus: memory and orientation
Neo cortex: cognition
Amygdala: emotions
Hypothalamus: actions

Incorporate the startle effect

flight, fight or freeze

Systemic failure mechanisms

Three phases of prospect systemic failure:

- Prospective expectations of improved performance may lead to optimization on a short term by collecting monetary profits from such performance. At the operator control level, the ETTO principle is considered a valid principle for profit optimization

Systemic failure mechanisms

- Speculative expectations trigger extrapolation of an existing, seemingly stable situation by validating such expectations as apparent future performance of the system. At the managerial level, added values of functionalities are reconsidered, creating functional resonance

Systemic failure mechanisms

- A final situation in which profit-taking is no longer covered by future developments due to a lagging investment in precautionary arrangements. Privatizing, outsourcing, deregulating, introduction of business principles such as Faster, Cheaper and Better, legitimize structural reductions on institutional investments in safety management and research funding and give control to market forces in introducing new developments.

Natuurlijke veroudering

- Verdringing: veiligheid, milieu, duurzaamheid, circulaire economie
- Nieuwe eisen en wensen: organisatorisch, maatschappelijk
- Opeenvolging van concepten en denkscholen
- Opbouw van kennisarsenaal: ongevallen, gebreken, wetenschappelijke onthullingen, operationele ervaring
- Grootschalige transities: energie (stoom, olie en elektriciteit), materialen (hout, metaal, composieten), informatie (digitalisering)
- Veranderingen in publieke perceptie en waardering (sociale media)
- Contractvormen (aanbesteding, verdienmodellen, aansprakelijkheid)
- Mensbeeld (Taylorisme, Goed Vliegerschap en Zeemanschap)

Kunstmatige veroudering

- Planned obsolencence (levensduurbeperking)
- Erosie van kennis en kunde (outsourcing, privatisering)
- Achterblijvende investeringen in R en D
- Competitieve concepten en noties (Resilience engineering, New View on human error, Duurzaamheid, Lerende organisaties, Safety 1 en Safety 2)
- Instrumentele en methodische grenzen: Fukushima, Deep Water Horizon, Air France 447

Changes in business models: contracts and cooperation

In aviation: Legacy carriers versus Low Cost Carriers

In infrastructure:

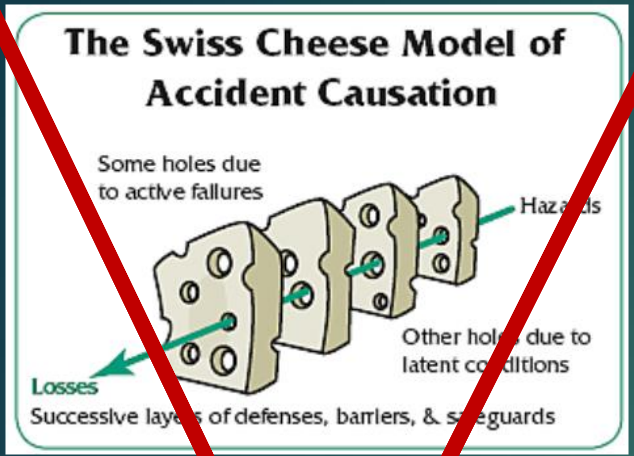
- Design and Construct (High Speed Line)
- Design, Build, Finance, Maintain (Nieuwegein Lock)

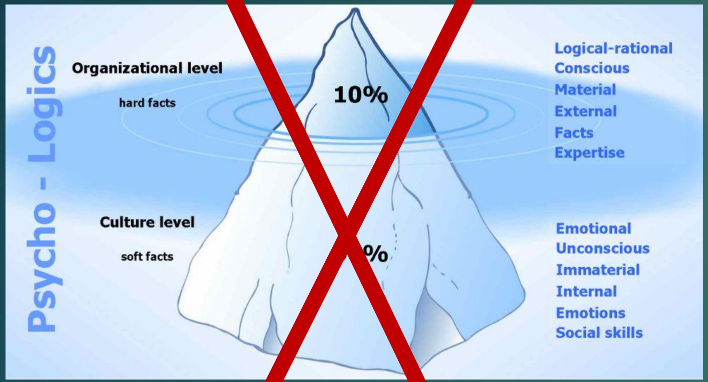
Differences in lead times, costs, responsibilities, communication and sharing information

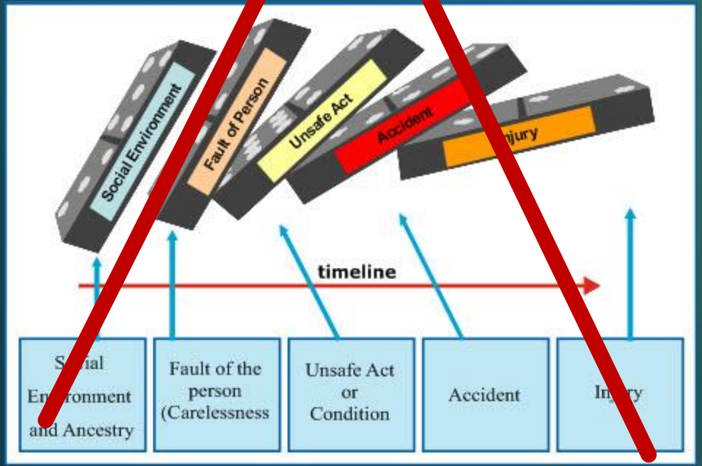
But also in *risk management and safety*

Integral engineering design

- Sustainable: closing value chains, circular economy
- Vision Zero: no emissions, no waste, no accidents
- Knowledge repository: transparency across life cycles about operational performance
- Integrating aspects and values:
  - Safety internal: occupational, process (maintenance), product, rescue and emergency
  - external: economy, environment, space, safety, security







New communication metaphors

Coping with complexity

A new framework
A new communication metaphor
To solve complex issues
In a dynamic environment
With a high socio-technological and
Knowledge intensive nature
Aiming at sustainable improvement

Remedies

- Prospectieve beoordeling: Veiligheids Effect Rapportage
- Simulatie en prototyping: serious gaming, concurrent engineering
- Knowledge Based Design, Value Engineering, Forensic Engineering
- Systeembenadering: state/space vector modelling, veranderings- en transitiemanagement
- Creative destruction (Schumpeter: afschaffen oude begrippen en concepten tav human error, verdien modellen, contractvormen. Veiligheidskundige mythen en metaforen: Heinrichs' IJsberg, Dominostenen, Zwitserse Kaasmodellen)
- Empirie (ongevals- en incidentenonderzoek, operationele praktijk)
- Democratische participatie (operationele kennis en ervaring)
- Integrale veiligheid: arbo, product, proces, crisis