A Systems-Informed Approach to Risk Management

Part I

Association for Experiential Education, 2021 International Conference, November 12, 2021

Jeff Baierlein, Director, Viristar

viristar.com
viristar.com/aee-risk

Outcomes

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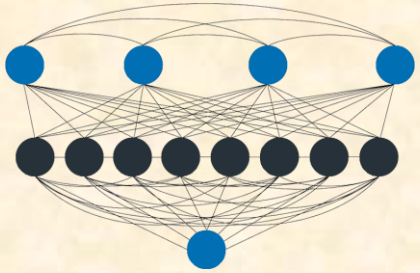
Participants will:

Understand recent advances in safety theories and models developed by risk management professionals across industries



Learn the Risk Domains model, based on systems theory, for managing risks at experiential education programs

Know where to go for additional information and resources on experiential program risk management best practice

Outline of Workshop

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Introduction

Large group discussion

Presentation:
Safety Science

Presentation: Applic-
ation to Experiential Ed

Self-Assessment

Discussion

Small group discussion

Closure

About Your Presenter

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Jeff Baierlein

- Experiential education professional since 1980s
- Executive Director at Boojum Institute for Experiential Education
- Executive Director at Outward Bound center
- Accreditation reviewer, former Board member, regional treasurer, AEE
- Currently, Director of Viristar, training and consulting

Why This Presentation?

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- AEE offers high quality safety-related accreditation standards

However:

- Risk management education often comes from tidbits of tips, ideas, & best practices from others
- Absence of unified understanding of:
  - What the current science says about why incidents occur
  - Theoretical models for risk management, based on best science & thinking, applicable to experiential programs

Safety Science

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The field of risk management includes:

- Career specialists
- Theories, models
- Academic journals
- PhD programs in risk management
- Best practices that apply across industries

Evolution in Safety Thinking

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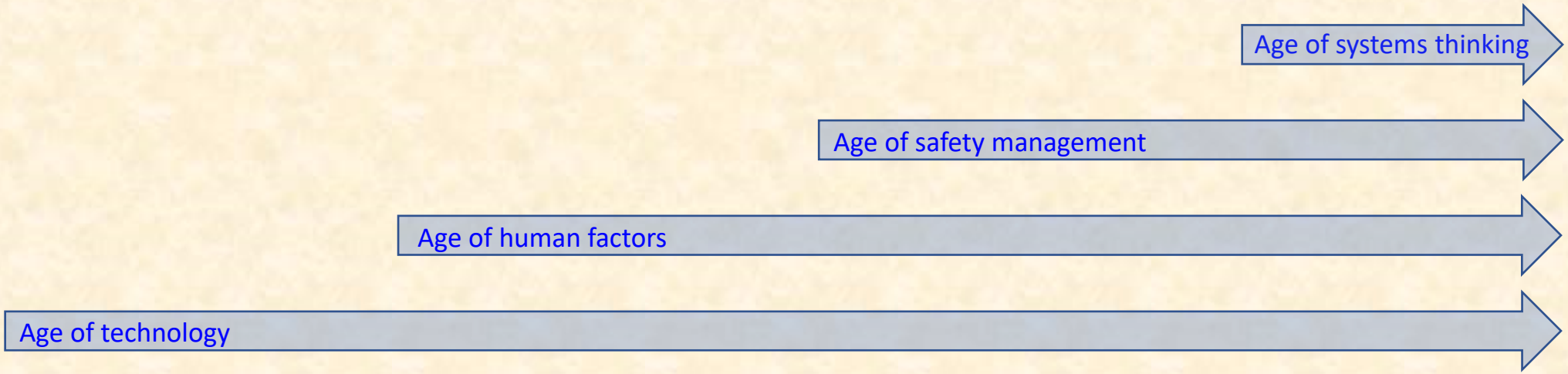

1800s	1970s	1980s	1990s
Technology	**Human Factors**	**Safety Management**	**Systems Thinking**
Humans as cogs in an industrial machine	Humans as hazards to be controlled	Adapting dynamically to risk environment	Complex socio-technical systems
Domino Model, Root Cause Analysis	Rules-based safety	Integrated safety culture	Resilience engineering

Adapted from: Defining the methodological challenges and opportunities for an effective science of sociotechnical systems and safety, Waterson et al., Ergonomics, 2015, Vol. 58, No. 4

Evolution in Safety Thinking

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Principle of causation	Single causes ('Root')	Multiple causes ('Latent')	Complex outcomes ('Emergent')
	OUTDATED	OUTDATED	CURRENT

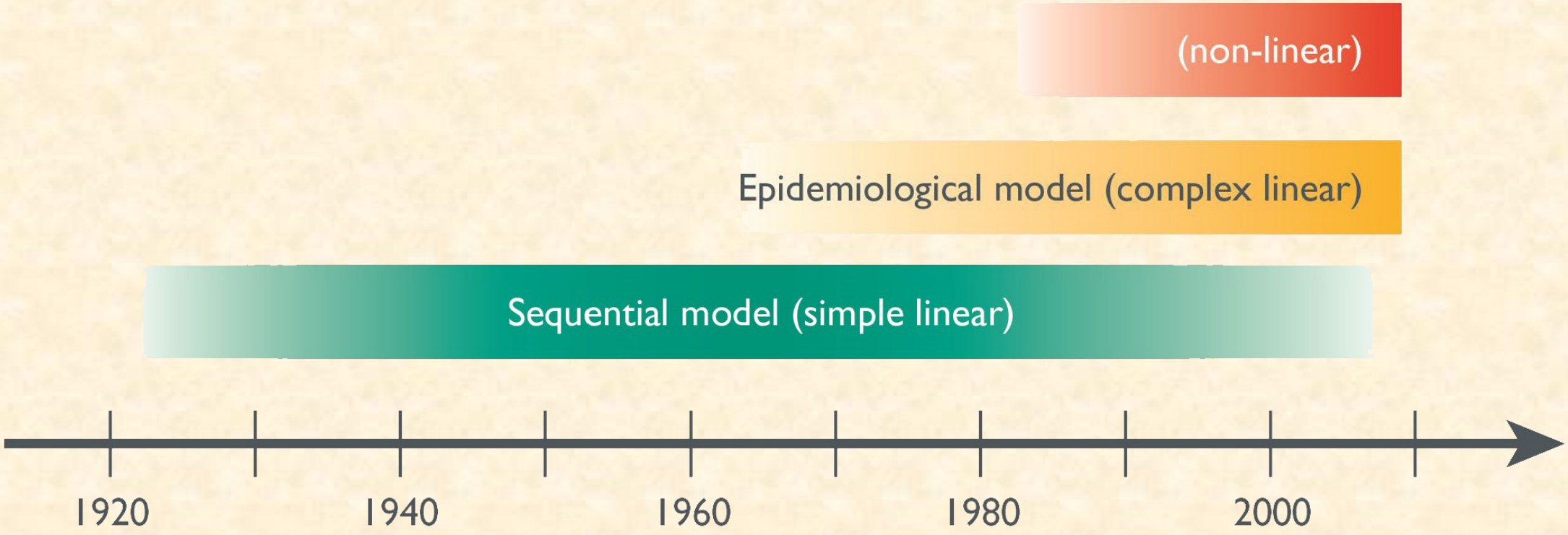
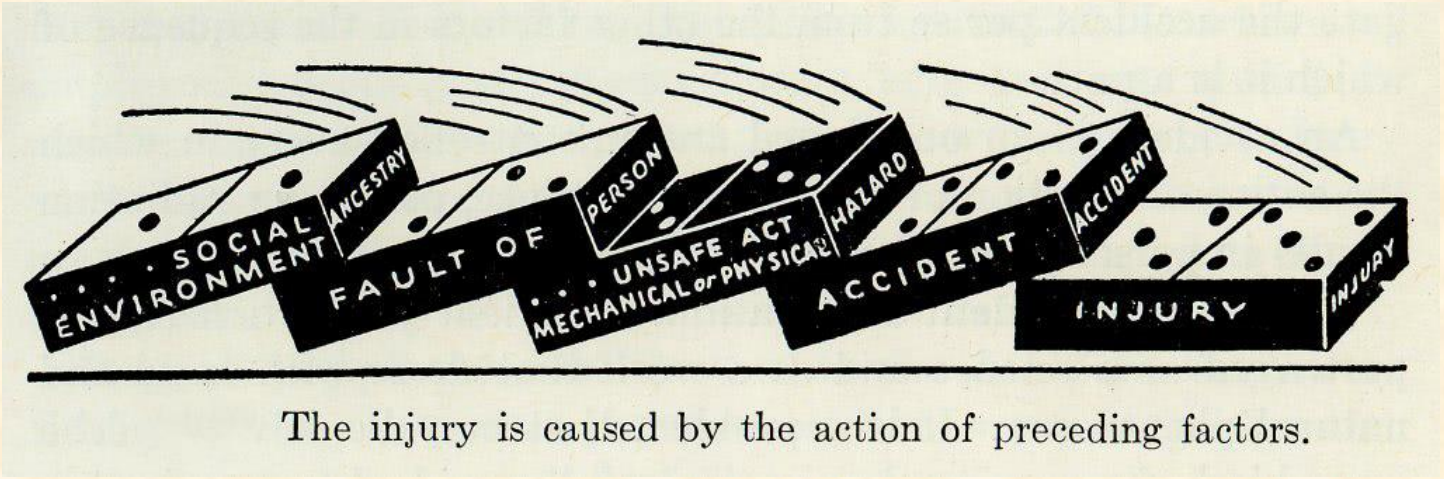


Image credit: HaSPA (Health and Safety Professionals Alliance).(2012). The Core Body of Knowledge for Generalist OHS Professionals. Tullamarine, VIC. Safety Institute of Australia.

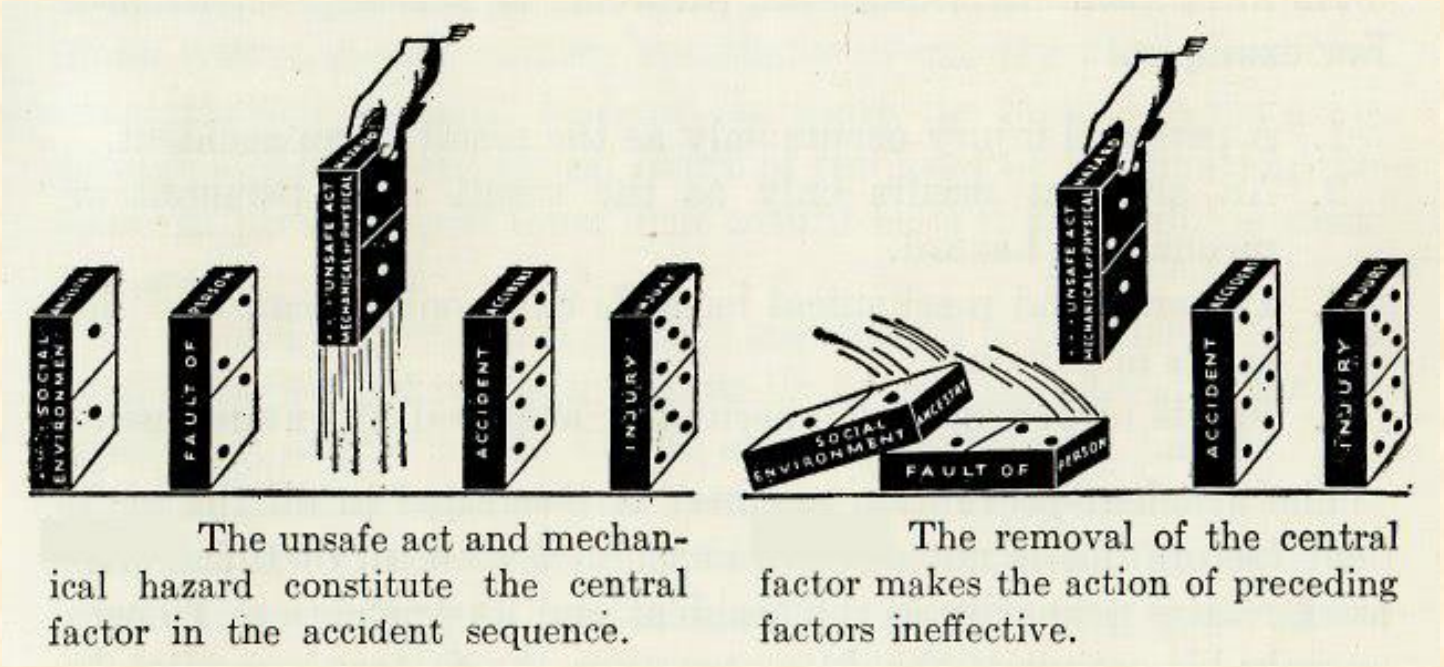
Linear Models

Domino model

Herbert Heinrich, *Industrial Accident Prevention*, 1931.



The injury is caused by the action of preceding factors.



The unsafe act and mechanical hazard constitute the central factor in the accident sequence.

The removal of the central factor makes the action of preceding factors ineffective.

Linear Models

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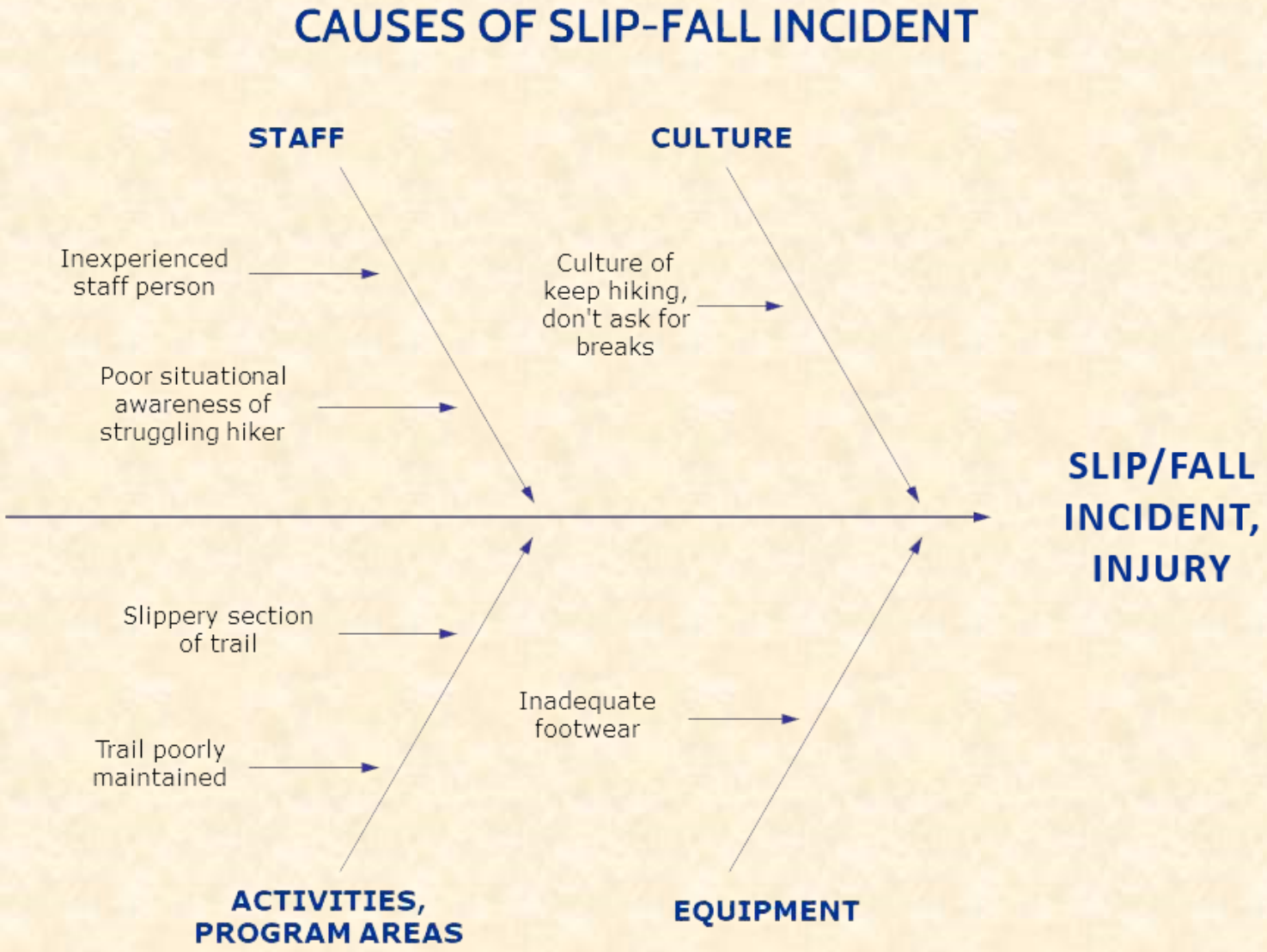
Fault tree analysis,
Fishbone diagram



Epidemiological Model

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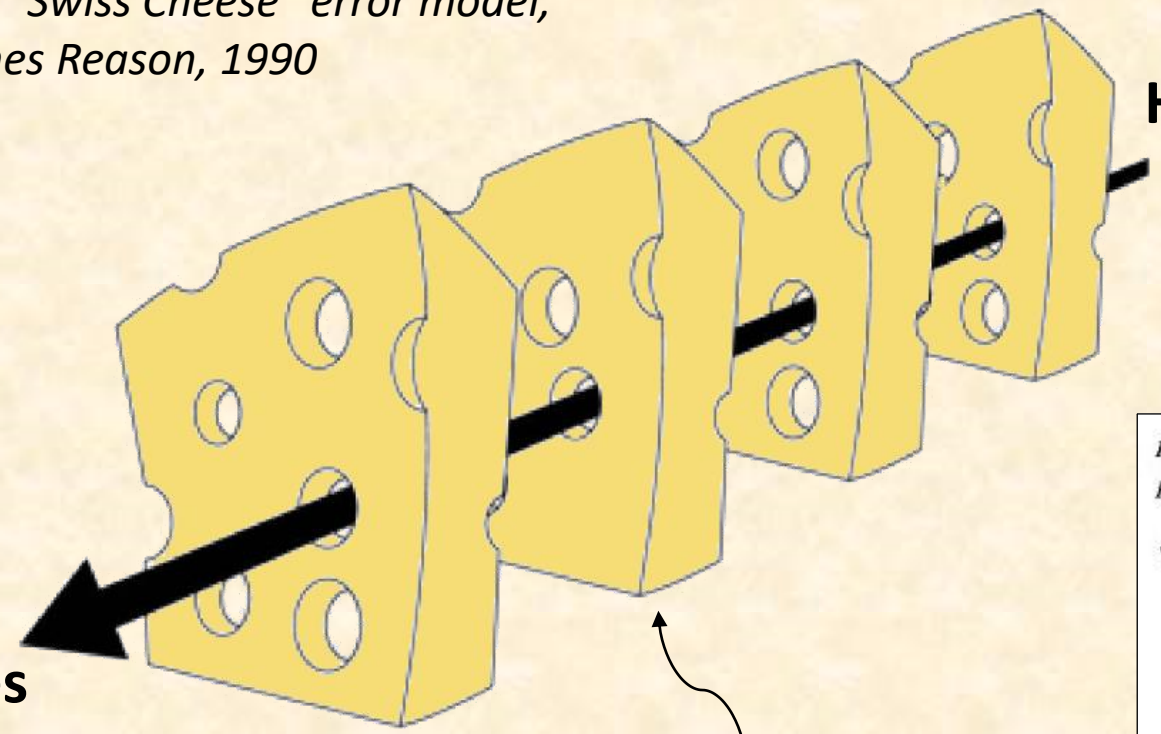
The "Swiss Cheese" error model, James Reason, 1990



- Events + latent conditions
- Like an exposure + a pathogen reservoir
- Complex linear model
- First systems model

Phil. Trans. R. Soc. Lond. B. **327**, 475–484 (1990)

Printed in Great Britain

The contribution of latent human failures to the breakdown of complex systems

By J. Reason

Department of Psychology, University of Manchester, Manchester M13 9PL, U.K.

Several recent accidents in complex high-risk technologies had their primary origins in a variety of delayed-action human failures committed long before an emergency state could be recognized. These disasters were due to the adverse conjunction of a

Complex Systems Model

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Characteristics of complex systems:

- Difficulty in achieving widely shared recognition that a problem even exists, and agreeing on a shared definition of the problem
- Difficulty identifying all the specific factors that influence the problem
- Limited or no influence or control over some causal elements of the problem
- Uncertainty about the impacts of specific interventions
- Incomplete information about the causes of the problem and the effectiveness of potential solutions
- A constantly shifting landscape where the nature of the problem itself and potential solutions are always changing

Examples of complex systems:

Global climate crisis

Inequity & exclusion

Experiential education

Complex Socio-technical Systems

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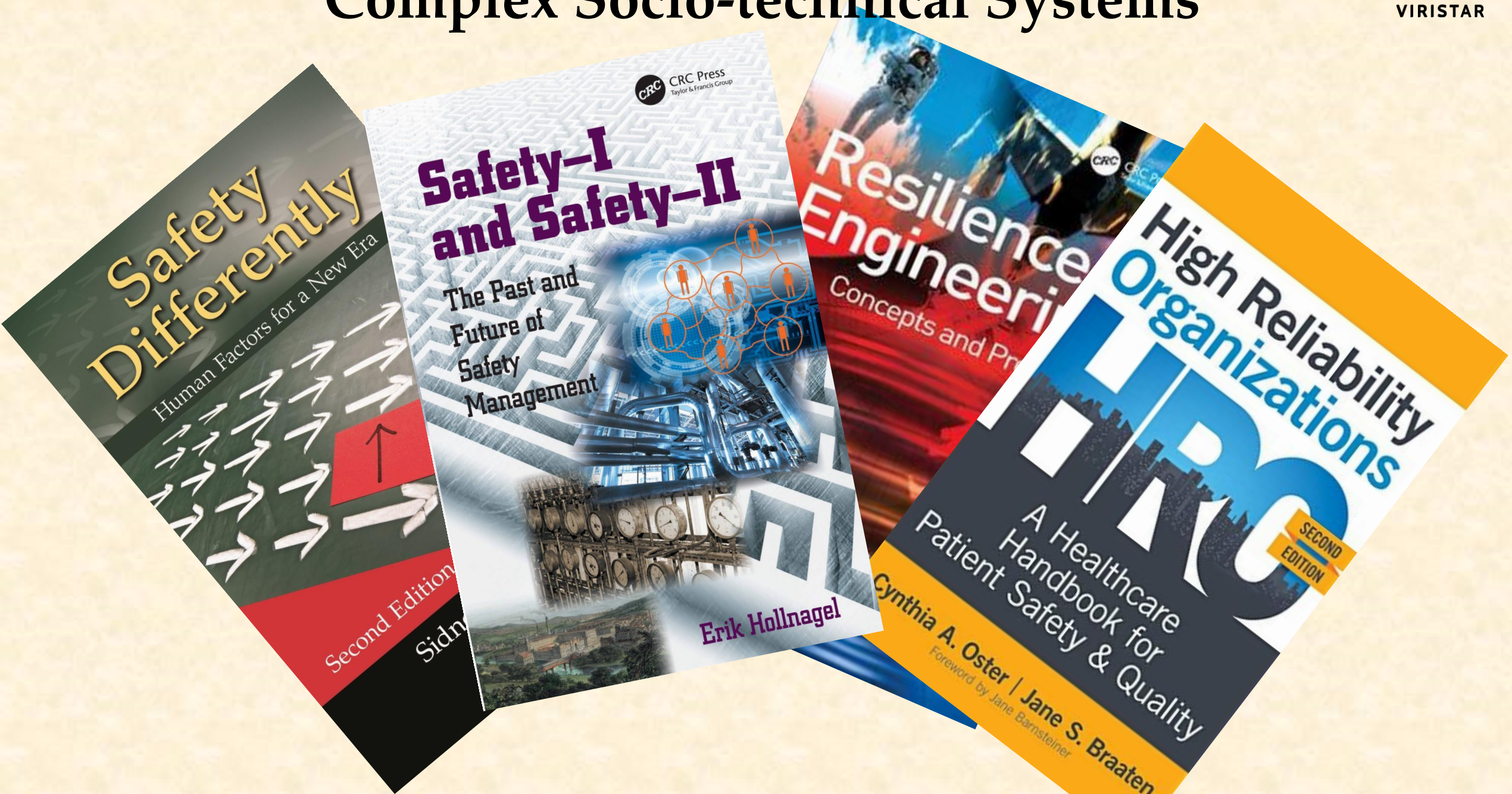

Complex Socio-technical Systems

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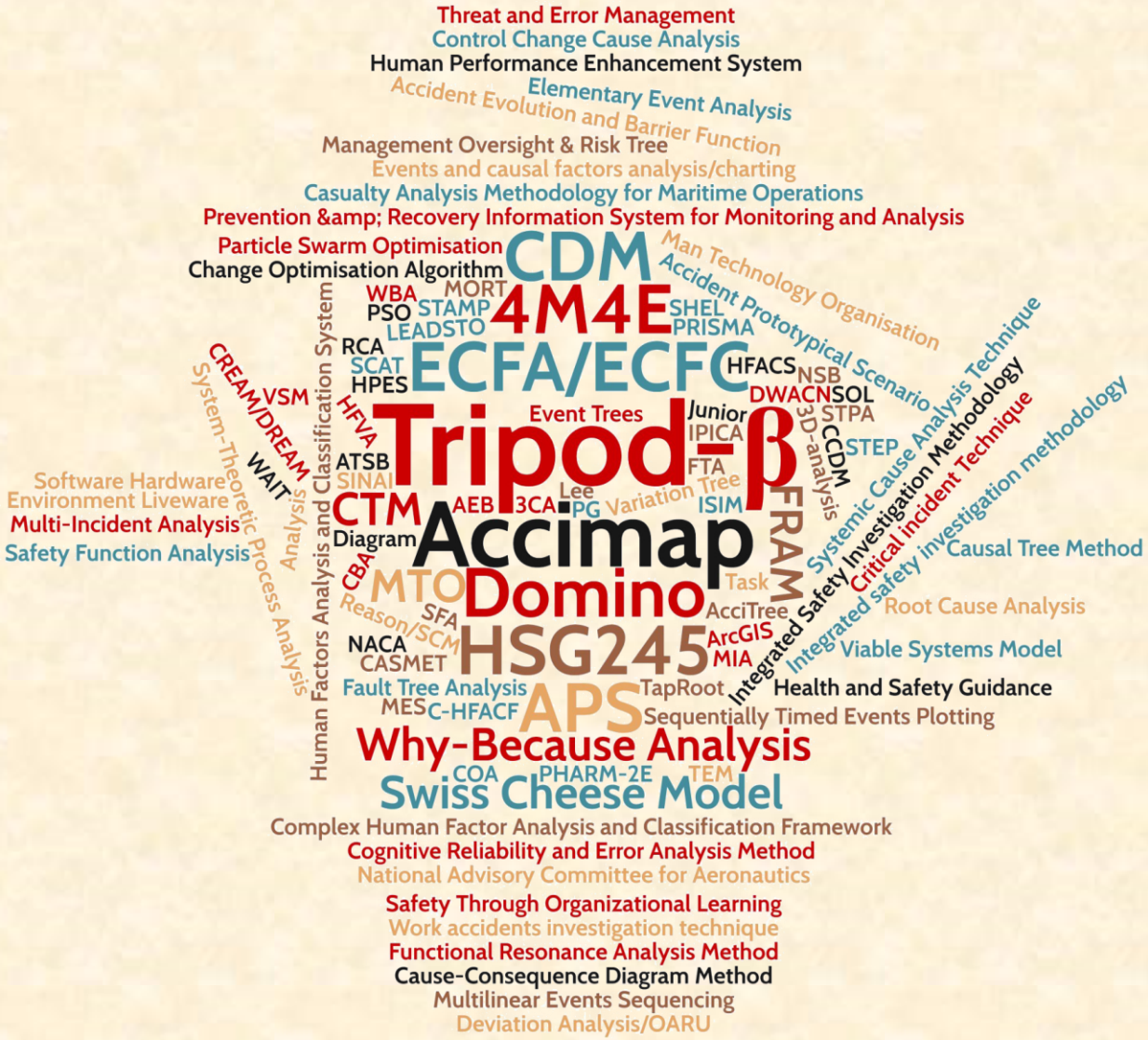

Government	*Passes laws*
Regulators, Associations	*Create regulations*
Company	*Sets policies*
Management	*Makes operating plans*
Staff	*Performs work actions*
Work	*May involve hazardouts processes*

AcciMap adapted from: Risk Management In a Dynamic Society: A Modelling Problem. Jens Rasmussen, Safety Science 27/2-3 (1997)

Complex Socio-technical Systems

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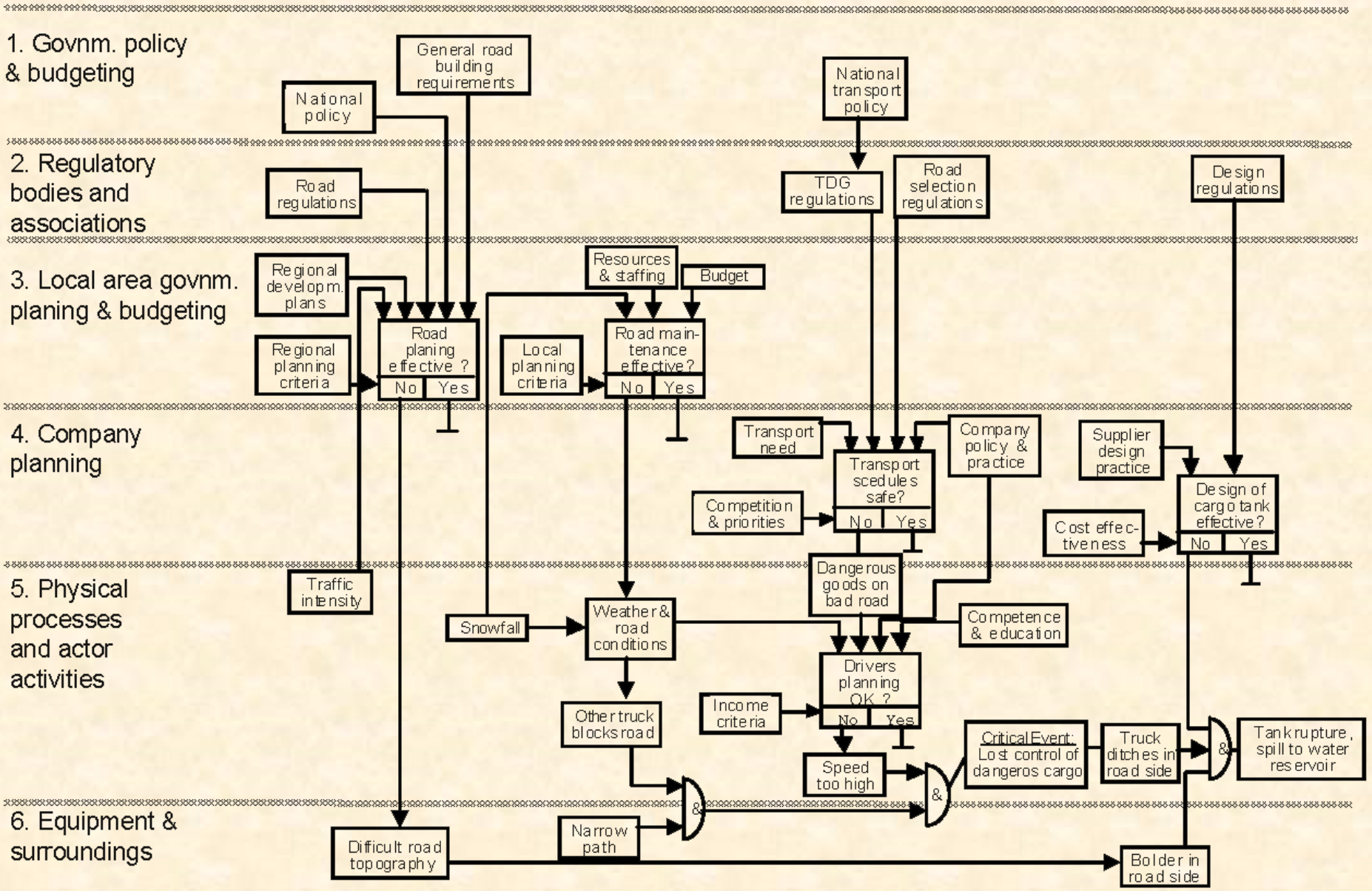

Complex Socio-technical Systems

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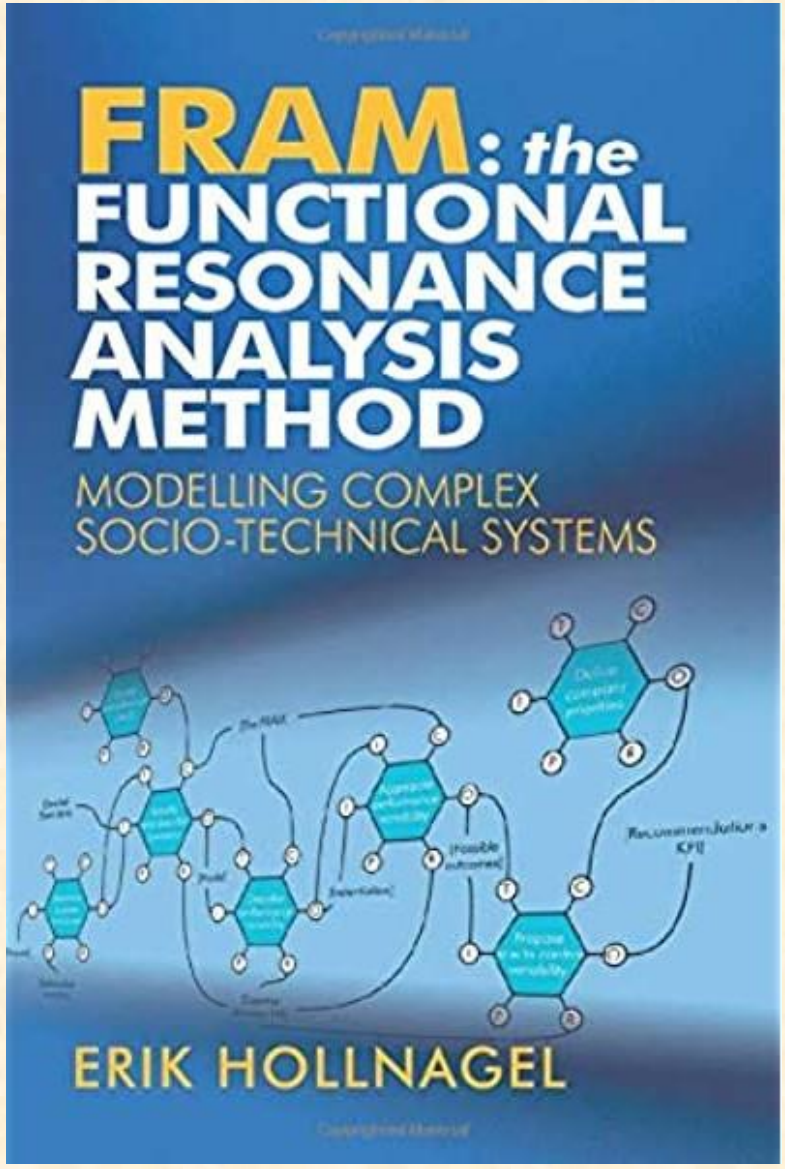

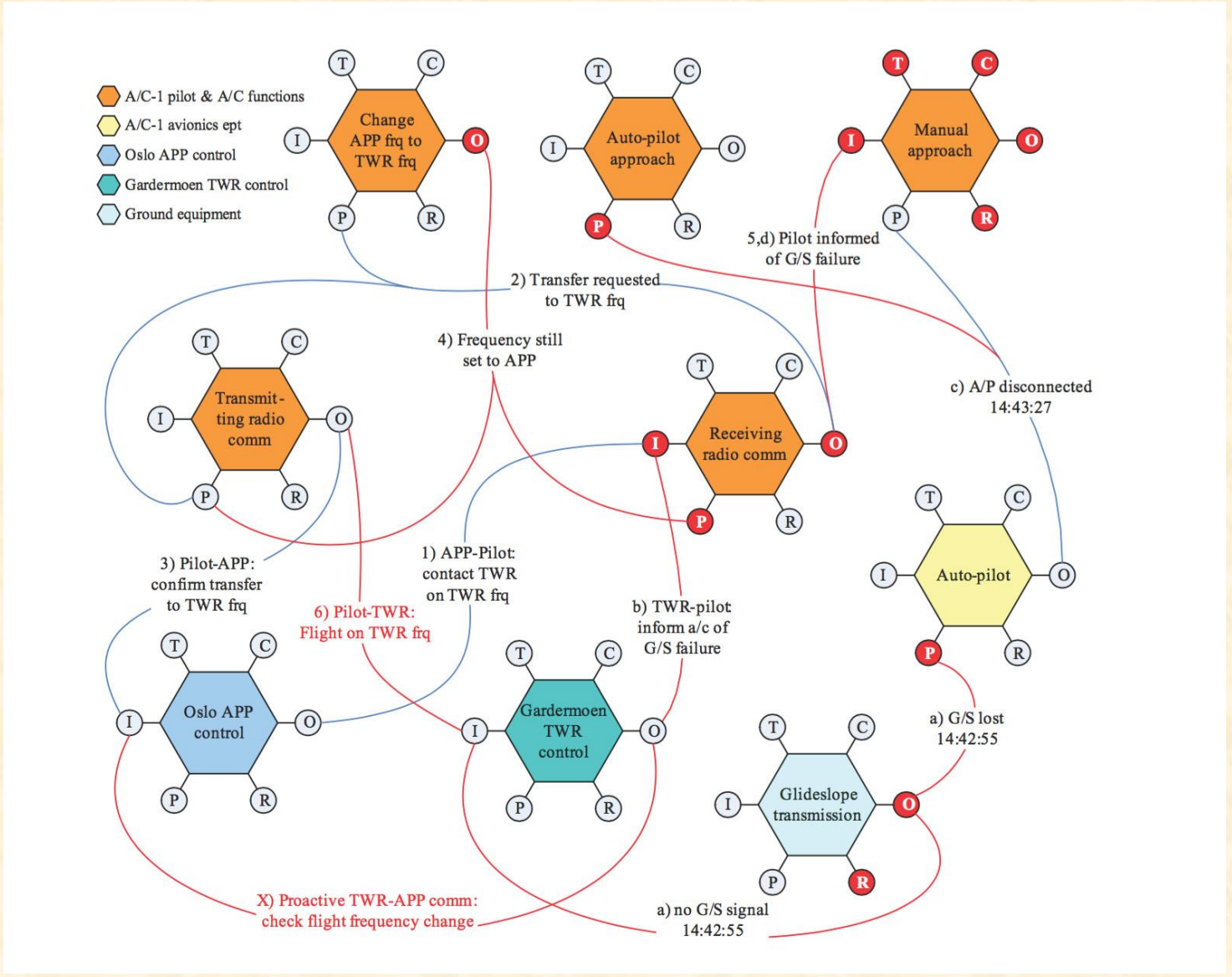

Risk Domains Model

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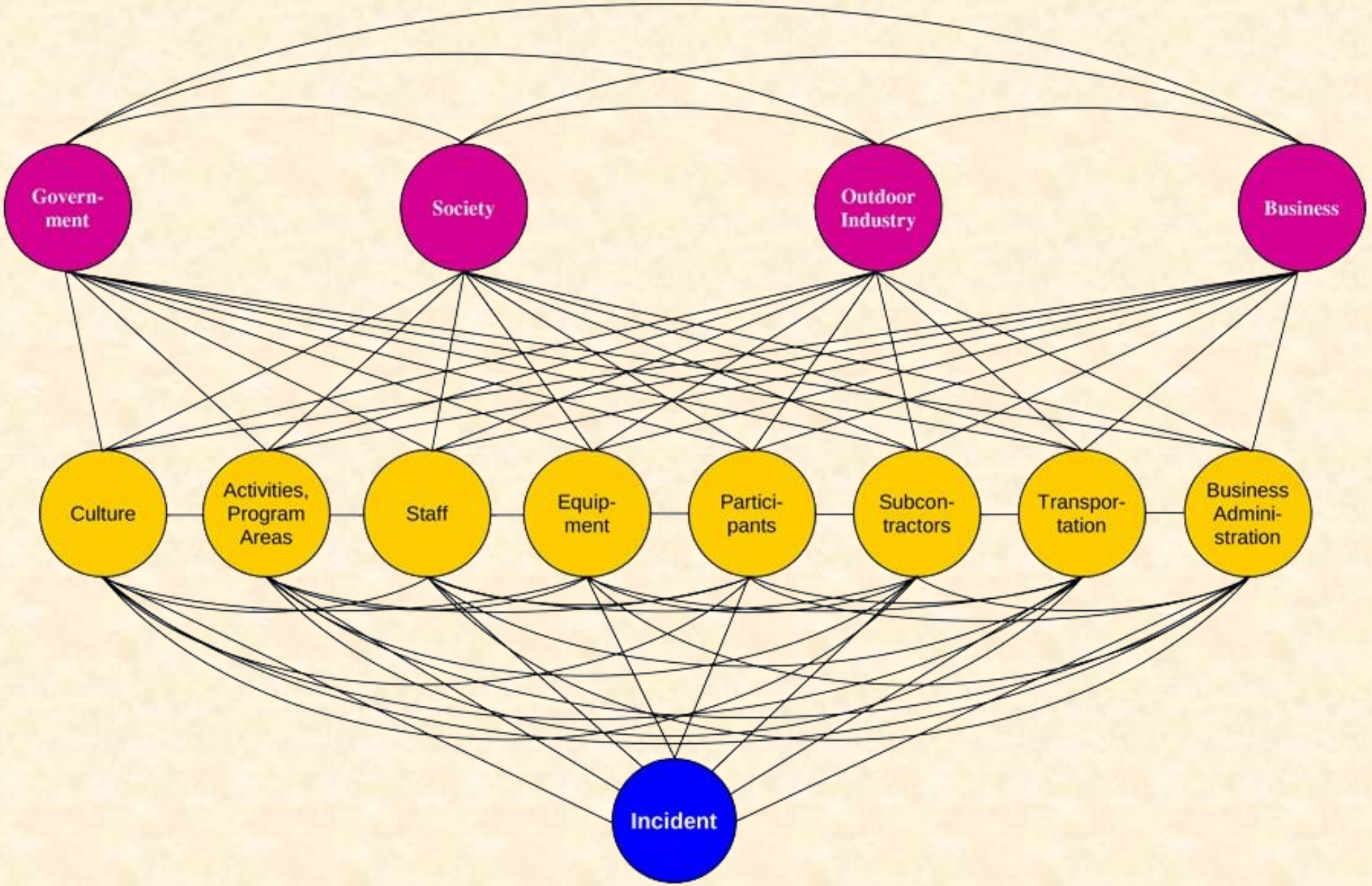

Risk Domains Model

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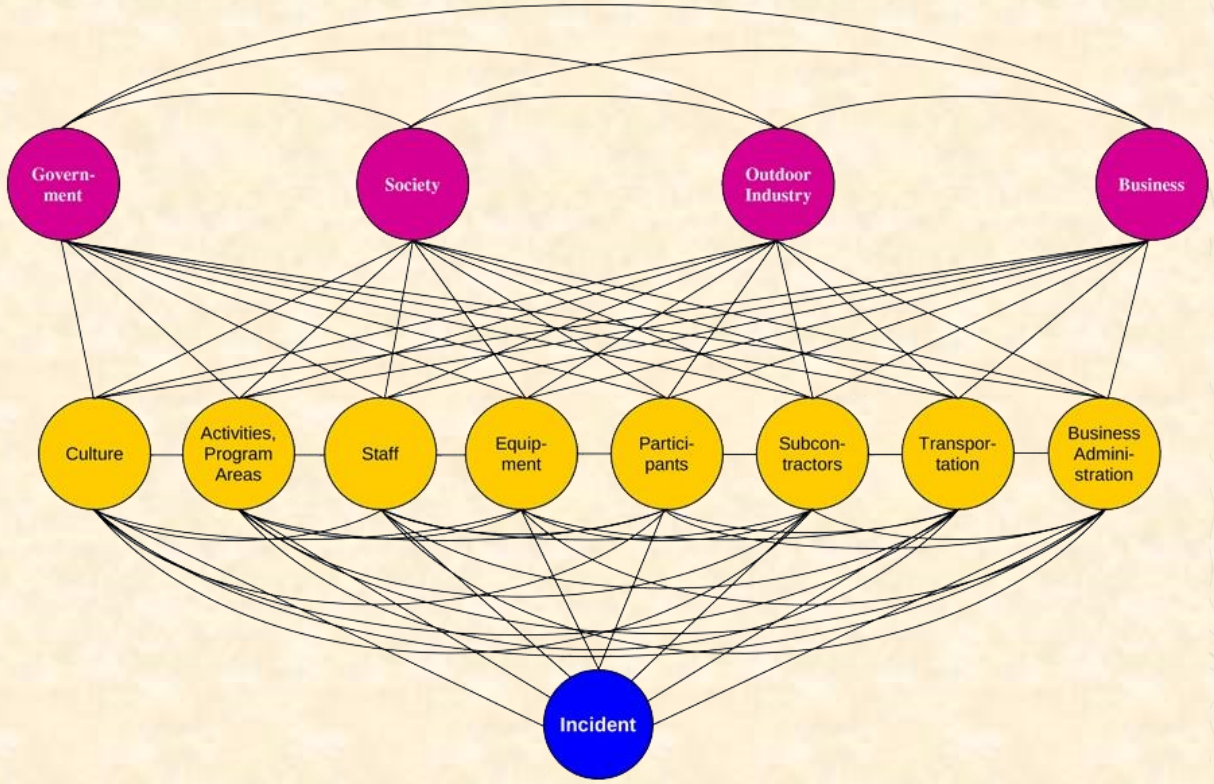

Risk Management Instruments

- Risk Transfer
- Incident Management
- Incident Reporting
- Incident Reviews
- Risk Management Committee
- Medical Screening
- Risk Management Reviews
- Media Relations
- Documentation
- Accreditation
- Seeing Systems

Manage risks in risk domains with policies, procedures, values and systems

Sidebar: Risk Assessments

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Limitations of Risk Assessments

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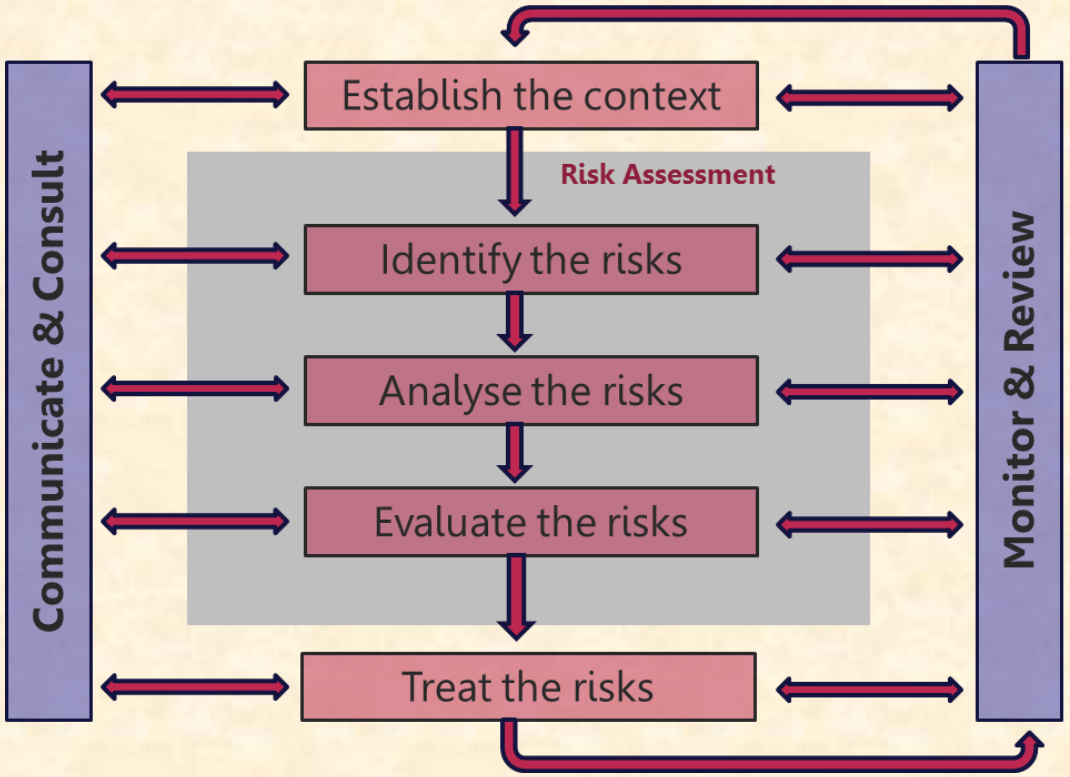
Probabilistic Risk Management (PRA) approach:

Risk	Probability	Magnitude	Treatment

		Magnitude		
		Slight	Moderate	Severe
Probability	Unlikely			
	Possible			
	Likely			



ISO 31000 Probabilistic Risk Management approach:

- Linear
- Weak on systems thinking
- Only applicable in limited situations

Limitations of Risk Assessments

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- Typically assesses only direct, immediate risks from specific activities, locations or populations, such as
  - weather
  - traffic hazards
  - equipment failure
- Typically **fails to account for underlying risk factors** such as:
  - poor safety culture
  - financial pressures
  - deficits in training & documentation
  - lack of regulatory oversight
- Typically **fails to account for human factors in error causation**, e.g.
  - cognitive biases
  - cognitive shortcuts (heuristics)
- **Fails to consider systems effects**: how multiple risks interact in complex and unpredictable ways that to lead to incidents

Limitations of Risk Assessments

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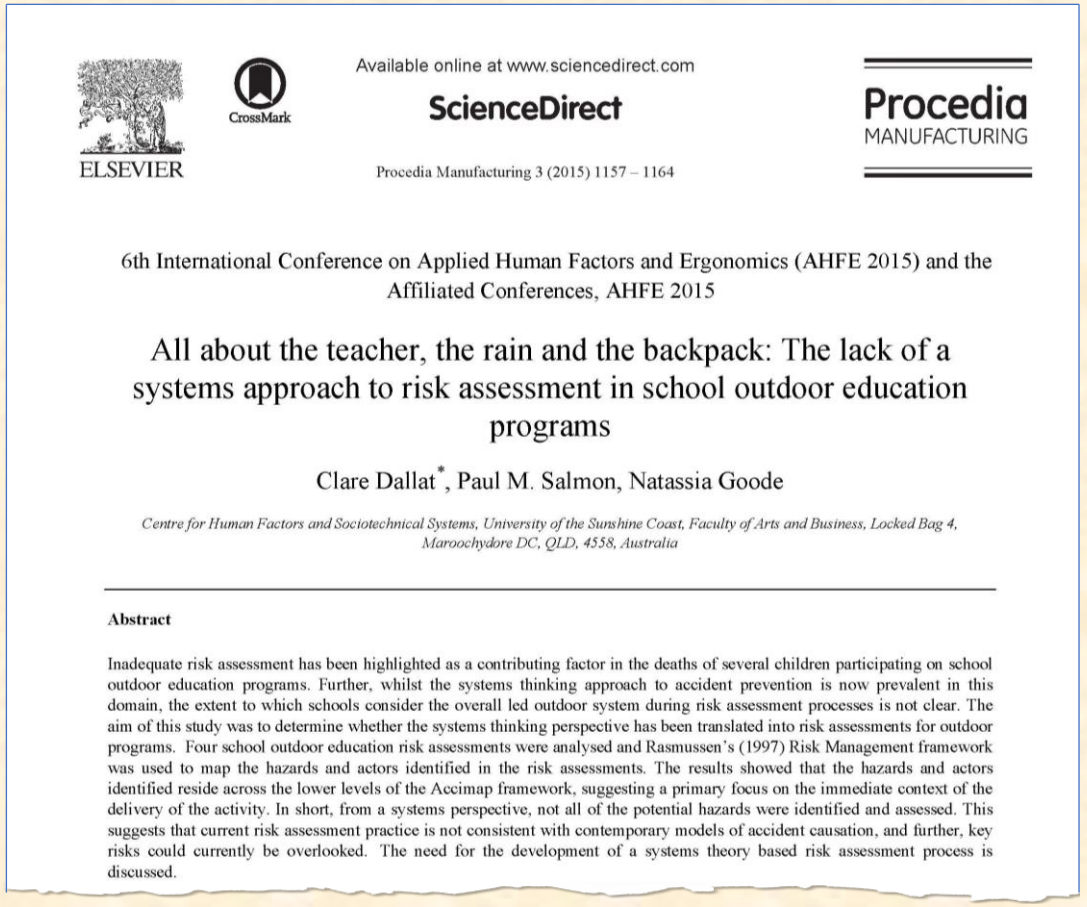
- Does not correlate with what research in complex socio-technical systems and human factors in error causation tell us about how incidents occur
- Therefore ineffective as a comprehensive risk management tool or stand-alone indicator of good risk management

"...current risk assessment practice is not consistent with contemporary models of accident causation."



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6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015

All about the teacher, the rain and the backpack: The lack of a systems approach to risk assessment in school outdoor education programs

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Abstract

Inadequate risk assessment has been highlighted as a contributing factor in the deaths of several children participating on school outdoor education programs. Further, whilst the systems thinking approach to accident prevention is now prevalent in this domain, the extent to which schools consider the overall led outdoor system during risk assessment processes is not clear. The aim of this study was to determine whether the systems thinking perspective has been translated into risk assessments for outdoor programs. Four school outdoor education risk assessments were analysed and Rasmussen's (1997) Risk Management framework was used to map the hazards and actors identified in the risk assessments. The results showed that the hazards and actors identified reside across the lower levels of the Accimap framework, suggesting a primary focus on the immediate context of the delivery of the activity. In short, from a systems perspective, not all of the potential hazards were identified and assessed. This suggests that current risk assessment practice is not consistent with contemporary models of accident causation, and further, key risks could currently be overlooked. The need for the development of a systems theory based risk assessment process is discussed.

Self-Assessment

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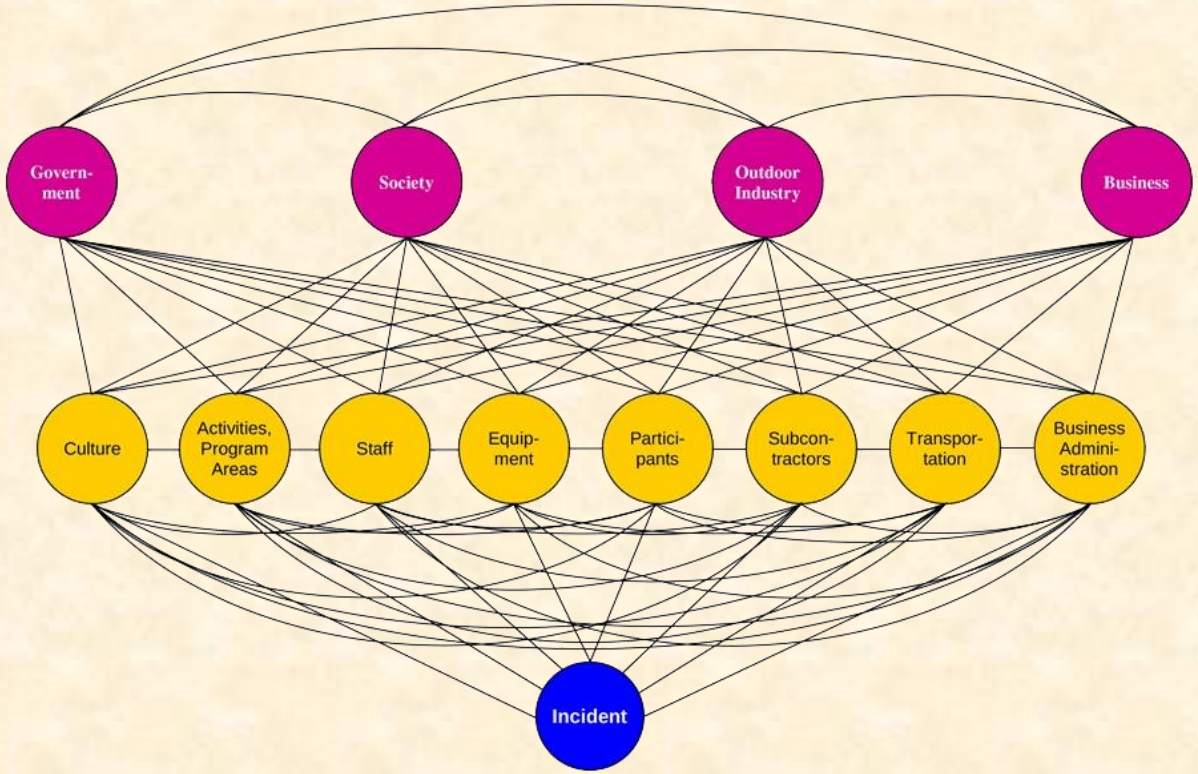
Complete the self assessment at viristar.com/aee-risk to evaluate if your organization:

- Identifies risks in each risk domain
- Institutes policies, procedures, values and systems to keep those risks below a socially acceptable level



- Employs all applicable Risk Management Instruments