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‘After Rasmussen’ – Recent Trends in Human Factors and Human Error



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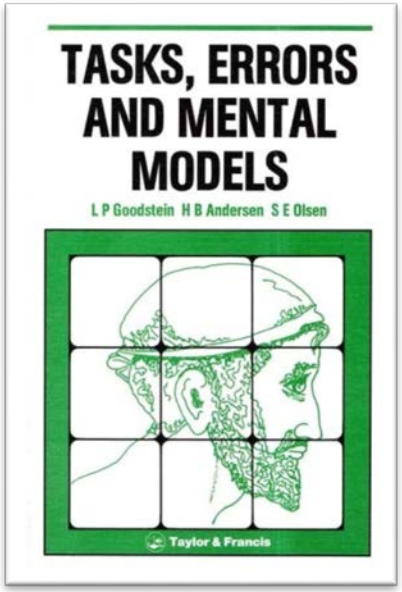
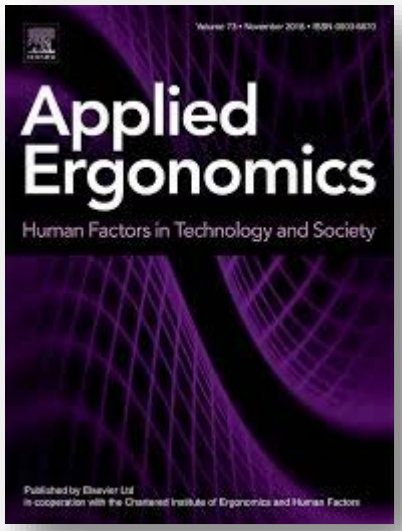
Technical University of Denmark (DTU) - Copenhagen
14th November 2018

Outline

- Jens Rasmussen (1926 - 2018)
  - Publication in 2017 of special issue on the legacy in Applied Ergonomics
  - 18 papers (Sanderson, Rouse, Leveson, Wears, Sheridan …)
  - Earlier Festschrift (1988) – 60th birthday
  - http://www.jensrasmussen.org/
  - ODAM 2014, 2017, 2020 (Stratford-upon-Avon)
- What I'll cover today
  1. Reflections on the legacy
  2. After Rasmussen – HFE and safety - where are we now?
  3. New directions – some issues





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Reflections on Rasmussen's leg

1. Rich set of influences and scholarship

- Herbert Simon – 'Ant on the Beach'
- Cybernetics (Ashby, Wiener et al)
- Signal Detection Theory
- Egon Brunswik – 'lens model' – links between and organism and its environment
- James Gibso… …tual

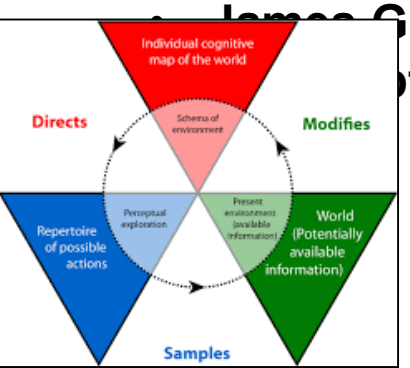
James Gibson
1904-1979

Ross Ashby
1903-1972

David Marr
1945-1980

Egon Brunswik
1903-1955

Ulric Neisser
1928-2012



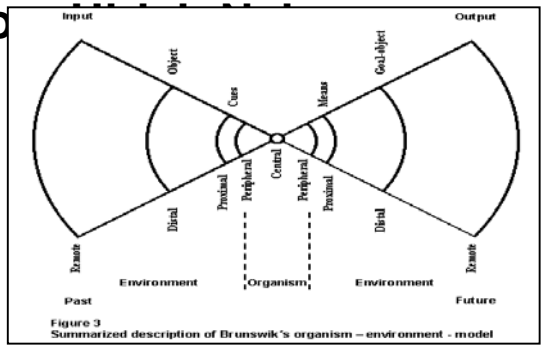
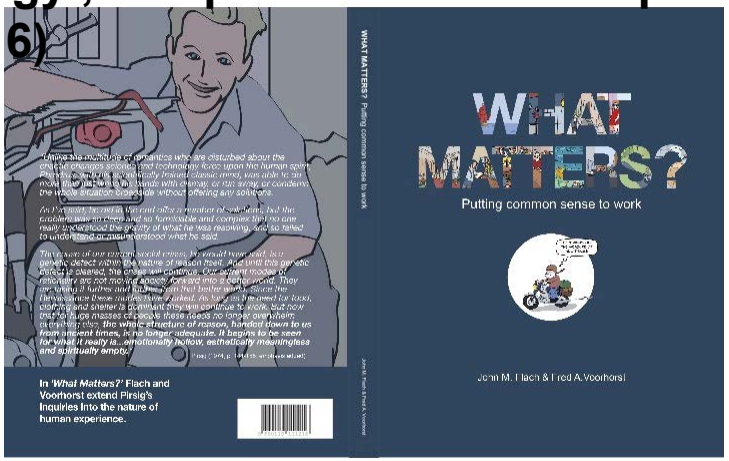


Figure 3
Summarized description of Brunswik's organism – environment - model

Reflections on Rasmussen‘s legacy

2. The ‘ecology of complex work’

- Abstracting cognitive processes from ‘real world’ context
- Ecological view of human error (vs. Lab-based studies – Reason, Norman)
- Aggregation of multiple contexts and situations (‘Shaking the Kaleidoscope – Barry Turner)
- ‘problem ecology’, ‘deep structure’ of complex work (Flach and Voorhorst, 2016)



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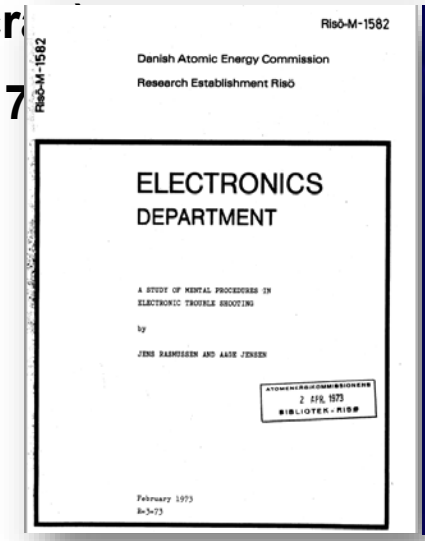
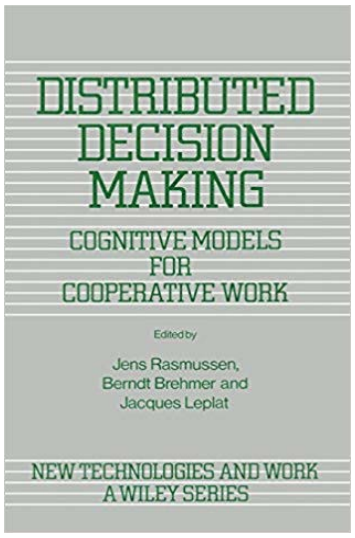
http://corescholar.libraries.wright.edu/books/127/

Reflections on Rasmussen‘s legacy

3. ‘Normal operations, normal accidents’

- Rasmussen and Jensen (1974) – electronic trouble shooting
- *“…risk management can only be discussed in depth when considering carefully the decision making involved in the normal operation of the hazardous processes posing potential for major accidents”* (Rasmussen and Svedung, 2000)”
- Compare with Perrow (1984) – Normal Accident Theory
- Weak signals (Carl Macr
- Safety II (Hollnagel, 2017

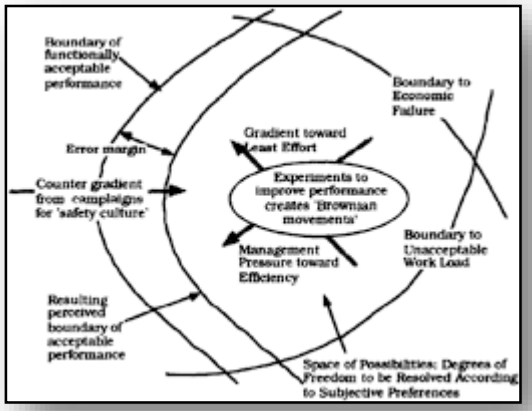




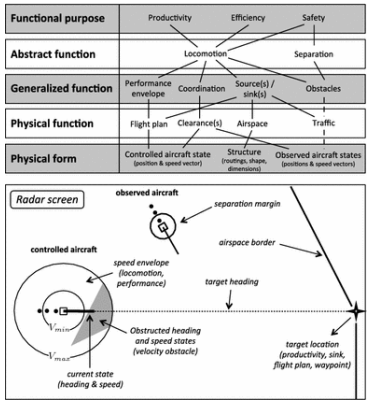
Reflections on Rasmussen's legacy

4. Pointing the way forward

- Tools, methods, models ('adaptive toolbox')
- 'Design Stance' (CTA, CWA, Decision ladder …)
- Inspiration for so many younger researchers (e.g., Greg Jamieson, J-C Le Coze, Paul Salmon, Neelam Naikar)

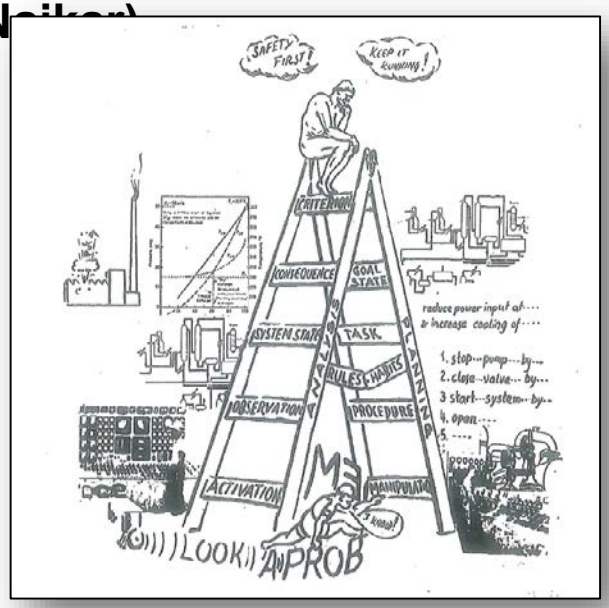


Brownian motion model of boundaries of safe performanc



Ecological Interface Desig

Decision Ladder



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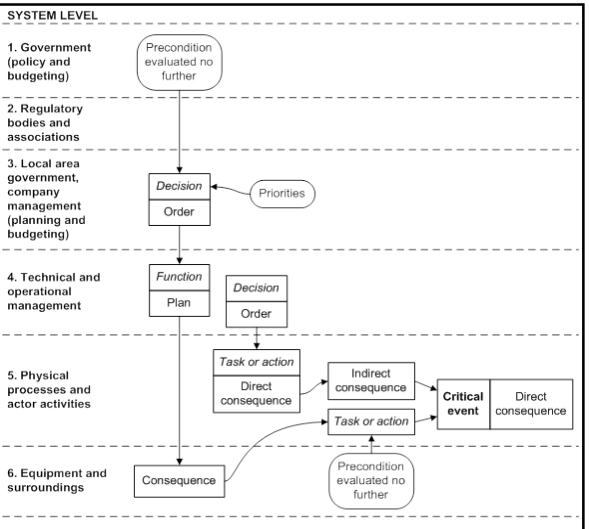
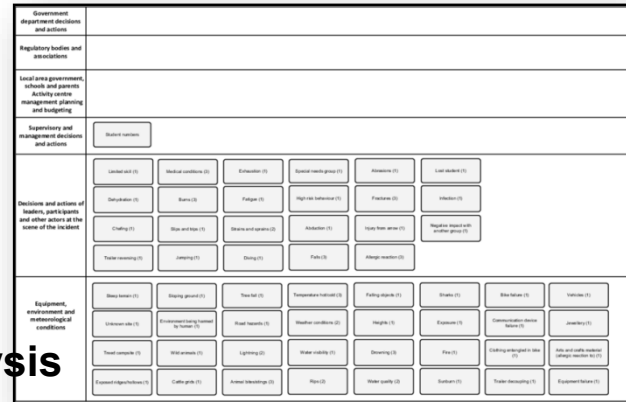
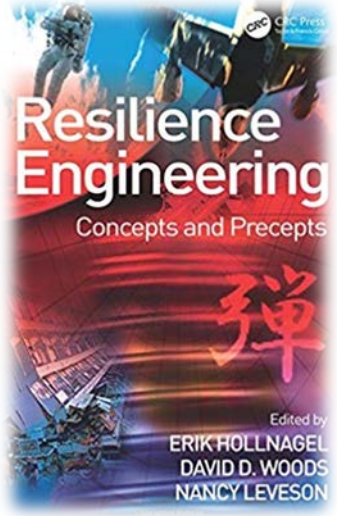


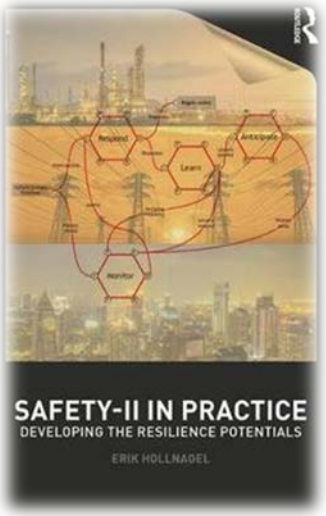
Cognitive Work Analysis

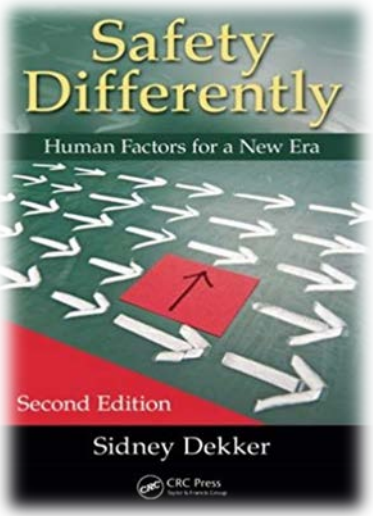


Post-Rasmussen – where are we now?

- **Rasmussen's work has generated lots of research, lots of exciting new ideas**
- **Progress in terms of safety of work environments has hugely improved since the 1970s**







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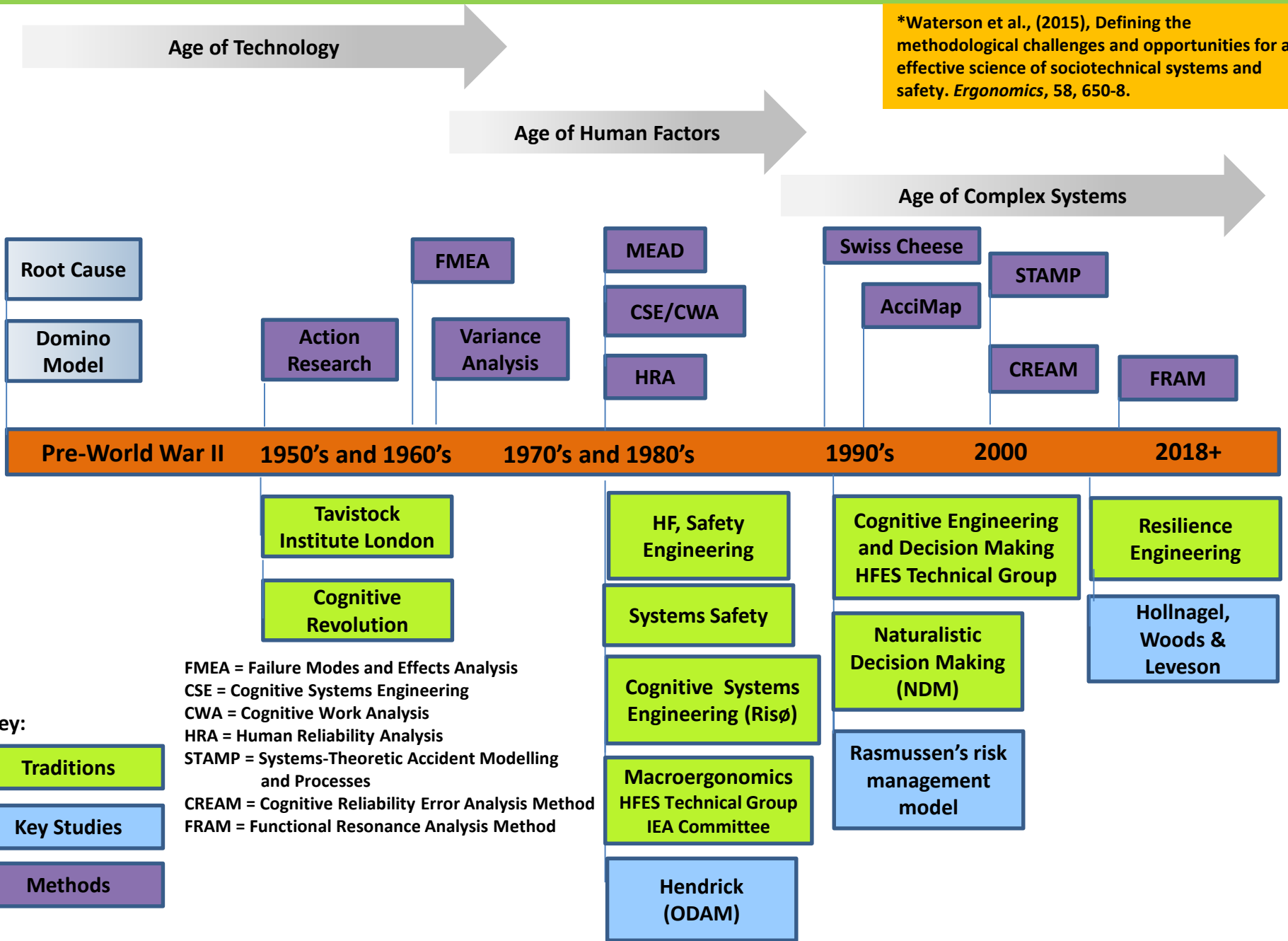
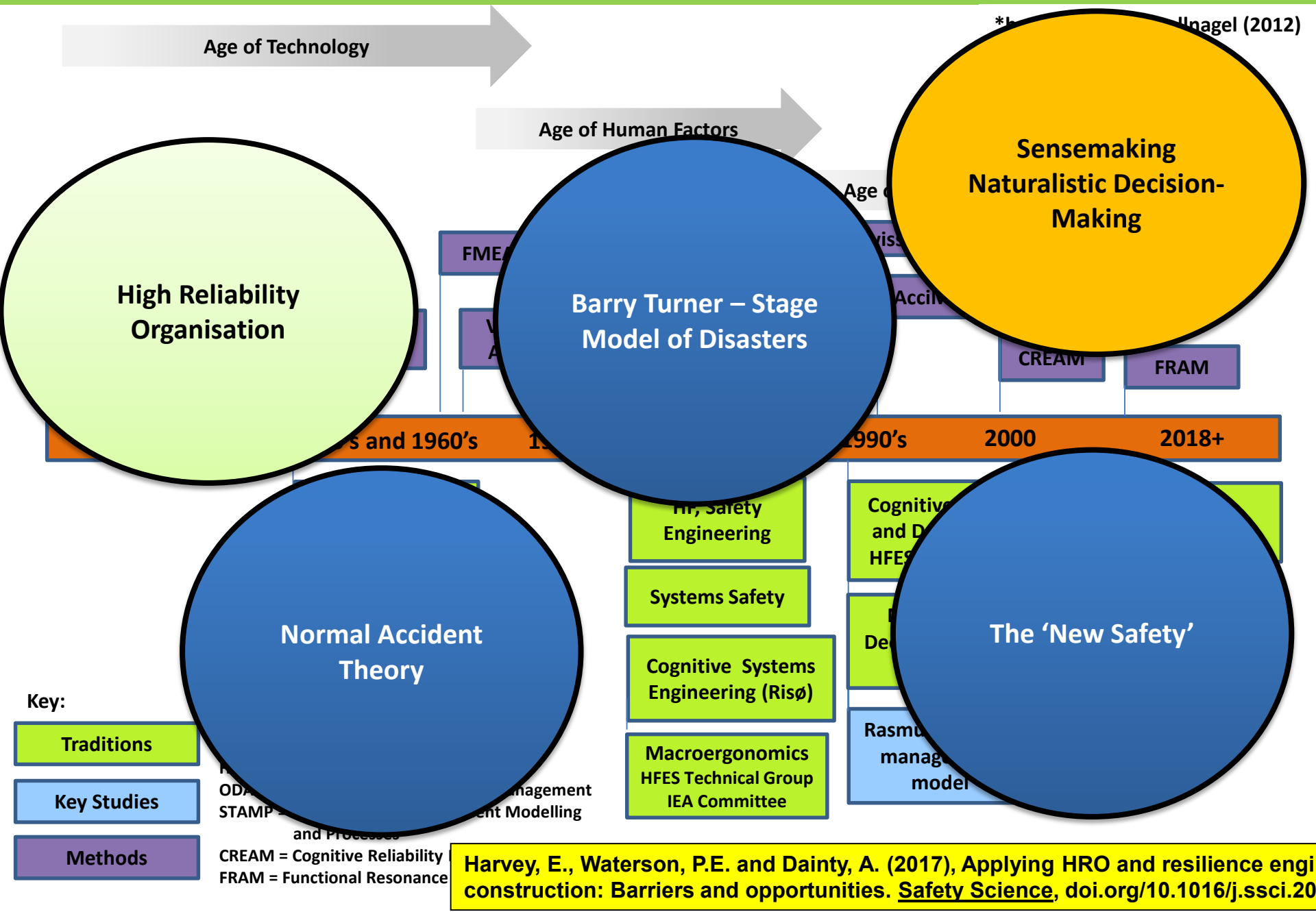
A Timeline of the Development of Methods for Complex Systems and Safety*

*Waterson et al., (2015), Defining the methodological challenges and opportunities for an effective science of sociotechnical systems and safety. *Ergonomics*, 58, 650-8.



A Timeline of the Development of Theories for Sociotechnical Systems and Safety*

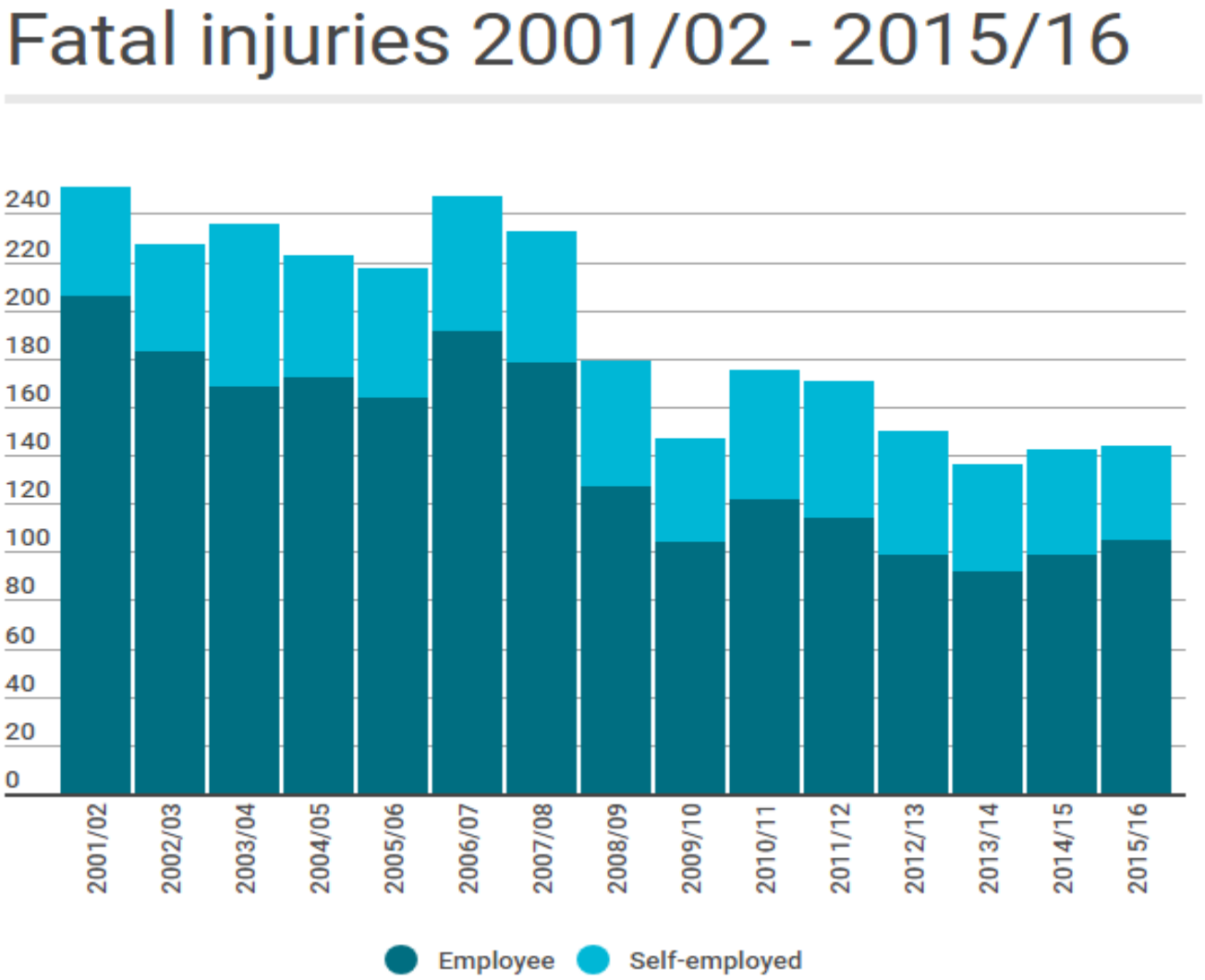


*Hollnagel (2012)

Harvey, E., Waterson, P.E. and Dainty, A. (2017), Applying HRO and resilience engi
construction: Barriers and opportunities. Safety Science, doi.org/10.1016/j.ssci.20

Workplace Safety – low risk/low hazard

Origins - The ‘Safety Plateau‘ – HSE, 2015



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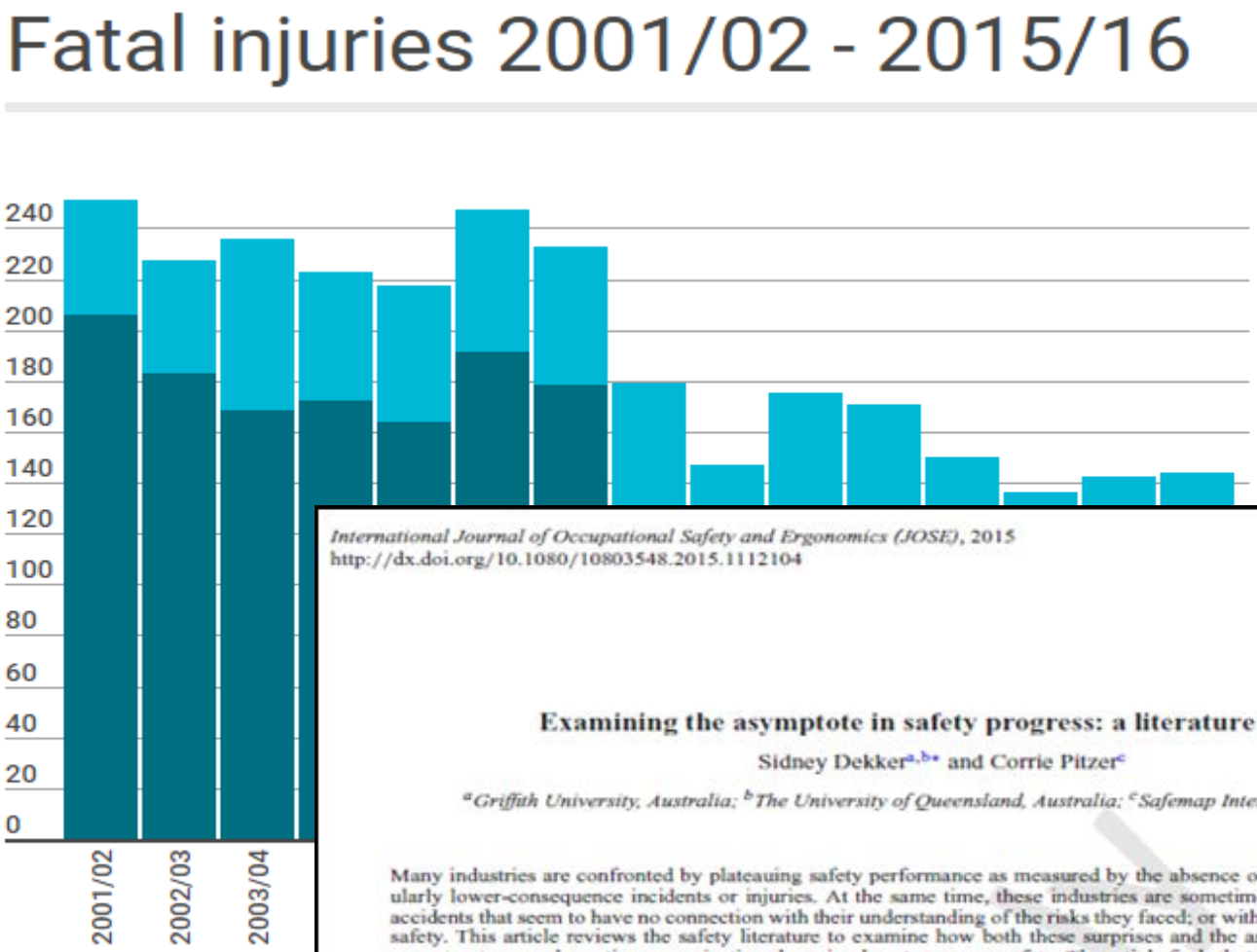


International Journal of Occupational Safety and Ergonomics (JOSE), 2015
http://dx.doi.org/10.1080/10803548.2015.1112104

Taylor & Francis

Examining the asymptote in safety progress: a literature review

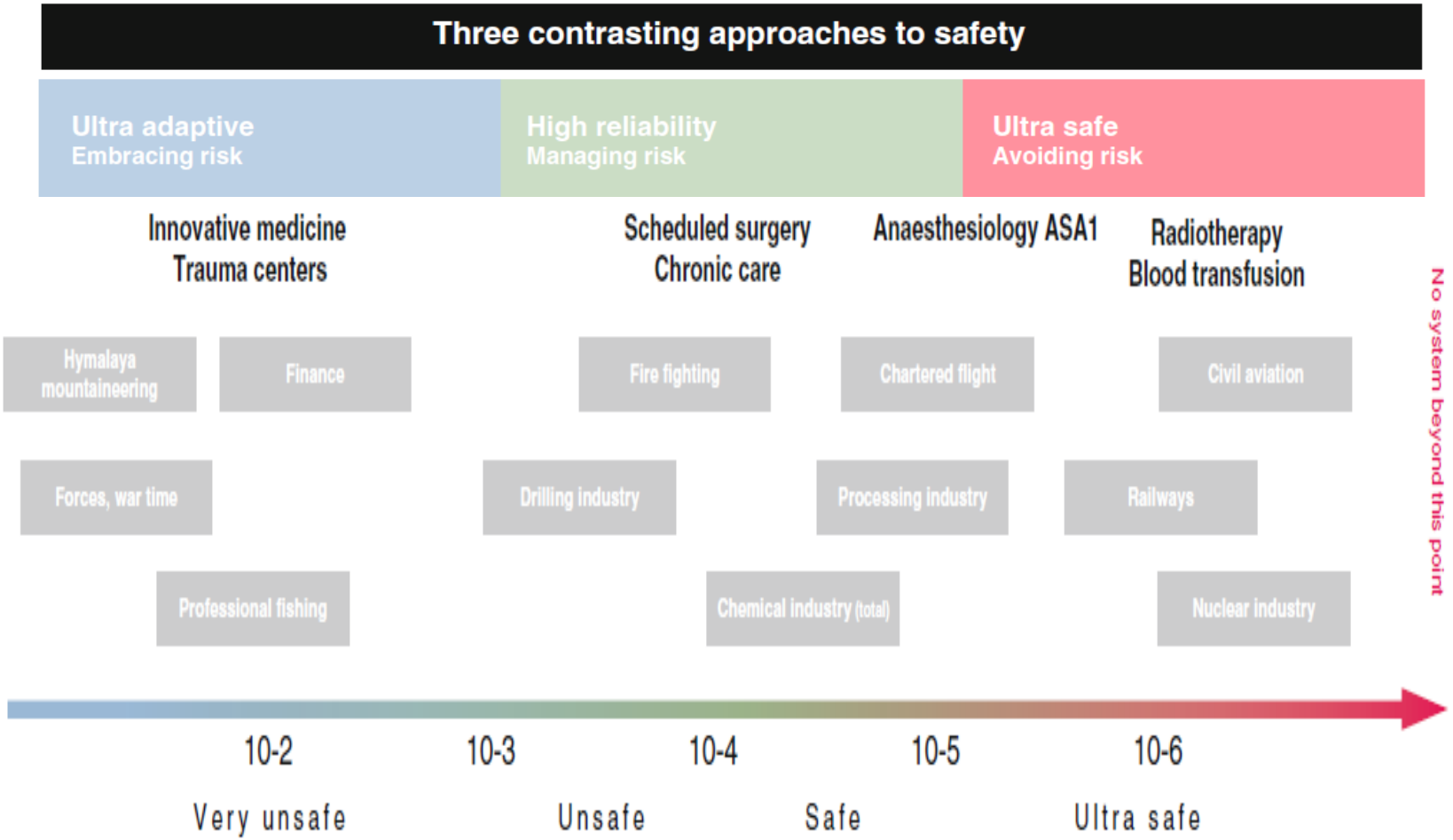
Sidney Dekker[a,b*] and Corrie Pitzer[c]

[a]*Griffith University, Australia;* [b]*The University of Queensland, Australia;* [c]*Safemap International, Canada*

Many industries are confronted by plateauing safety performance as measured by the absence of negative events – particularly lower-consequence incidents or injuries. At the same time, these industries are sometimes surprised by large fatal accidents that seem to have no connection with their understanding of the risks they faced; or with how they were measuring safety. This article reviews the safety literature to examine how both these surprises and the asymptote are linked to the very structures and practices organizations have in place to manage safety. The article finds that safety practices associated with compliance, control and quantification could be partly responsible. These can create a sense of invulnerability through safety performance close to zero; organizational resources can get deflected into unproductive or counterproductive initiatives; obsolete practices for keeping human performance within a pre-specified bandwidth are sustained; and accountability relationships can encourage suppression of the ‘bad news’ necessary to learn and improve.

System Safety – high risk/high hazard

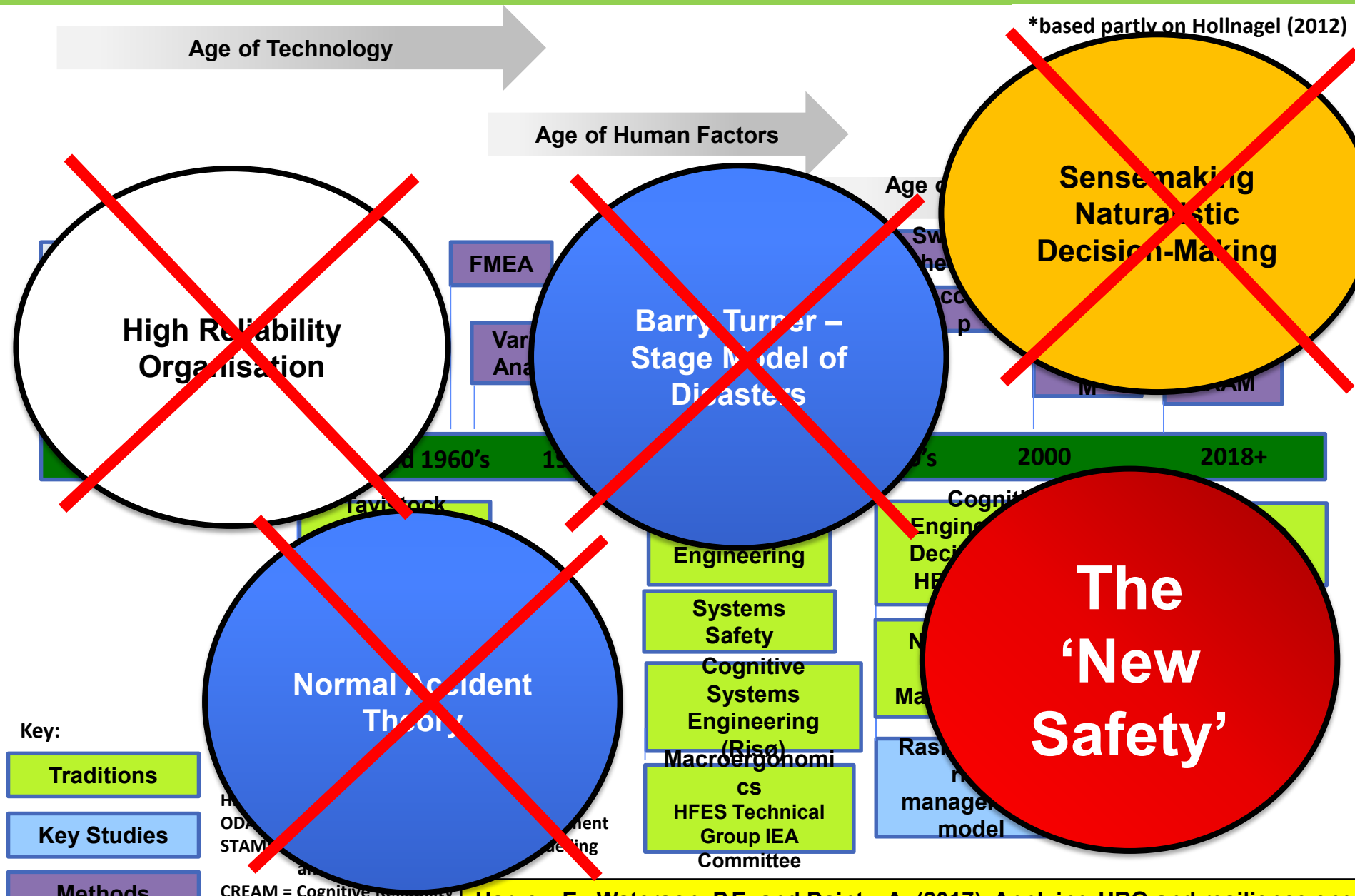
Origins – Paradox of Almost Totally Safe Systems (René Amalberti)



Vincent, C., & Amalberti, R. (2016). Safer healthcare. *Cham: Springer International Publishing*
http://www.fadq.org/wp-content/uploads/2016/02/Strategies_Real_Worldd.pdf

A Timeline of the Development of Theories for Sociotechnical Systems and Safety*

*based partly on Hollnagel (2012)



Harvey, E., Waterson, P.E. and Dainty, A. (2017), Applying HRO and resilience engi
construction: Barriers and opportunities. Safety Science, doi.org/10.1016/j.ssci.20

What is meant by the 'New Safety'?

- Loose collection of ideas, concepts, constructs, methods …. theories?
  - Safety I vs. Safety II (Hollnagel), 'Work as done' vs. 'work as imagined' (Wears), Safety Differently (John Green, Steve Shorrock UK and others), Human Error – the new look (Woods, Cook et al.)
  - Moving away from 'root causes' to systemic failure
  - Drift into failure, 'Just Culture' (Dekker)
  - Resilience engineering (Hollnagel et al.)
  - Vision zero, zero harm (Zwetsloot et al.)
  - New methods – e.g., STAMP (Leveson), FRAM (Hollnagel)
  - Second order Cybernetics (Ashby, Beer and the VSM ….)*

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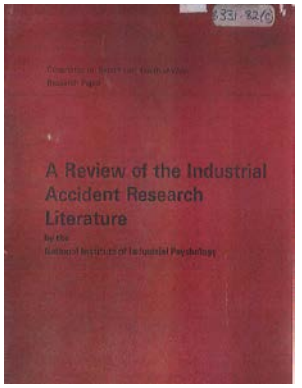
*Baber, Golightly and Waterson - Special Issue of *Applied Ergonomics* on 'Quantifying Complex, Dynamic Systems: The C
https://www.journals.elsevier.com/applied-ergonomics/call-for-papers/special-issue-on-quantifying-complex-dynamic-systems-th

‘New Safety‘ – Motivation and Origins

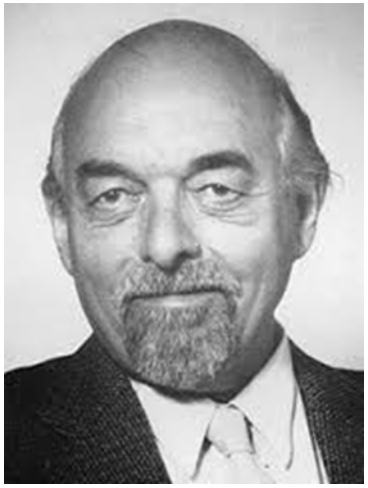
- **Much of it promoted by a dissatisfaction with progress, need for new ideas – excitement, new blood, beyond ‘Swiss Cheese’ etc**
- **Retrospective vs. prospective accounts of accidents**
- **‘Normalisation of error’; Empowering managers and workers (‘Safety intelligence’ – Fruhen, Flin)**

	OLD	NEW
Definition/ Focus	Ensuring as “few things go wrong as possible”	Ensuring as “many things as possible go right”
Safety Management Principle	Reactive Approach	Proactive Approach
Risk Management Approach	Identify causes, contributory factors and constrain performance, by reinforcing compliance and eliminating variability	Understand conditions where performance variability can become difficult to monitor and control
View of “Human Role”	Predominantly a liability or hazard	Necessary resource for system functioning
Foundations	Systems are decomposable, Functioning is bimodal, Work-as-imagined	Performance is variable, Performance adjustments are essential, Work-as-done
Mechanisms	Causality Credo, Linear causation models	Emergent
Manifestation	Occurrence of accidents or recognised risks	All possible outcomes
Example of Models	Swiss cheese model	Resilience
Example of Tools	Root cause analysis	FRAM

Review of the Accident Literature (Hale and Hale, 1972) ->

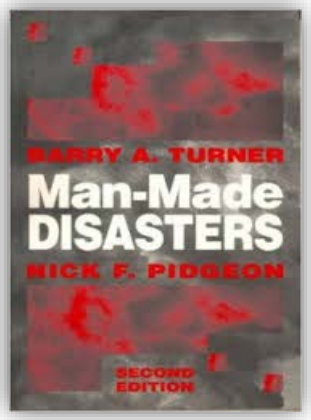


Some problems – 1. We forget the past



1.2.2 The term "human error" is of no help in accident prevention because although it may indicate WHERE in the system a breakdown occurs, it provides no guidance as to WHY it occurs. An error attributed to humans in the system may have been design-induced or stimulated by inadequate training, badly designed procedures or the poor concept or layout of checklists or manuals. Further, the term "human error" allows concealment of the underlying factors which must be brought to the fore if accidents are to be prevented. In fact, contemporary safety-thinking argues that human error should be the starting point rather than the stop-rule in accident investigation and prevention.

ICAO Doc 9683, written in 1992...



1978 (1st Ed.)

Applied Ergonomics 59 (2017) 471–482

Contents lists available at ScienceDirect

Applied Ergonomics

journal homepage: www.elsevier.com/locate/apergo

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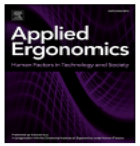

Editorial

Recurring themes in the legacy of Jens Rasmussen

CrossMark

1989

Waterson, P.E., Le Coze, J-C and Boje-Andersen, H. (2017), Recurring themes in the legacy of Jens Rasmussen. Applied Ergonomics, 59, Part B, 471-482.

Some problems – 2. Evidence, data, theory…

- Very little empirical evidence (so far)
- Quite a lot of talk, some of it rhetorical?
- Compare this with the volume of material we have from traditional and more recent ways of looking at safety (human error taxonomies, HRA, safety culture)
- May change – Dekker (Woolworths, Australia; Wears, USA)
- STAMP, FRAM – many applications (how many by non-academics?)
- Need to synthesize ideas, concepts (HRO, NAT…)


Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/ssci

ELSEVIER

'Accident investigation in the wild' – A small-scale, field-based evaluation of the STAMP method for accident analysis

Peter Underwood [a,*], Patrick Waterson [b], Graham Braithwaite [c]

[a] DCA Design International Ltd, 19 Church Street, Warwick CV34 4AB, UK
[b] Human Factors and Complex Systems Group, Loughborough Design School, Loughborough University, Loughborough LE11 3TU, UK
[c] Cranfield Safety and Accident Investigation Centre, Cranfield University, Martell House, University Way, Cranfield MK43 0TR, UK

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Some problems – 3. Research and practice gaps

- **Many safety practitioners are interested in new ideas (e.g., Safety II), but also frustrated - how does it apply to me and my workplace?)**
- **Some misconceptions (researchers and practitioners) – e.g., Vision Zero**
- **Some existing things work well (Swiss Cheese, fault trees, timelines – UK RAIB)**
- **We don't know that much about practice! (e.g., the role of safety practitioners in real practice and why they succeed or fail in their role of enacting change and improvement (Andrew Hale)**


POLICY AND PRACTICE IN HEALTH AND SAFETY, 2016
VOL. 14, NO. 2, 97–98
http://dx.doi.org/10.1080/14773996.2016.1261814

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Taylor & Francis

EDITORIAL

Bridging the gap between research, policy and practice in health and safety

This issue of the journal represents the second one since I took over as Editor-in-Chief of *Policy and Practice in Health and Safety* (PPHS) at the beginning of 2016. Some readers will have noticed some

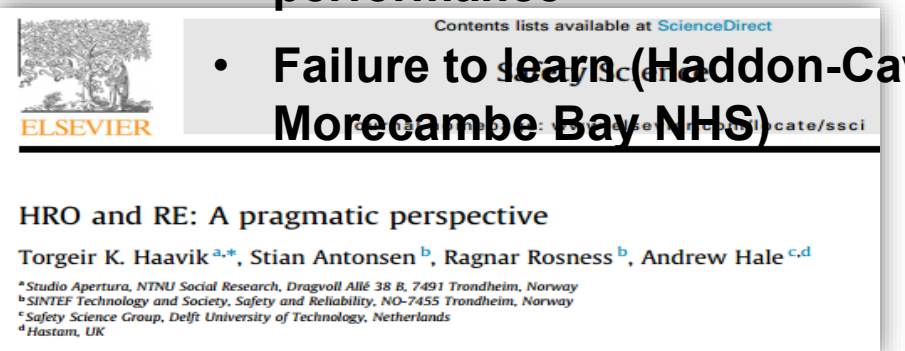
nd low-risk (workplace

Some problems – 4. We've only gone so far with 'old safety'

- Safety culture – 'science' is still immature (patient safety)
- The role of the regulator and safety culture
- Case studies of how safety culture unfolds in companies and sectors
- Comparative studies across nations
- Using "big data" to monitor/predict safety performance
- Failure to learn (Haddon-Cave, Morecambe Bay NHS)

Grenfell Tower
June 2017

> "*There are no approaches in safety science that capture into one theory or model everything that explains why and how failures and successes are achieved'*
> *Haavik et al., (2017, in press)*



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ELSEVIER

HRO and RE: A pragmatic perspective

Torgeir K. Haavik [a,*], Stian Antonsen [b], Ragnar Rosness [b], Andrew Hale [c,d]

[a] Studio Apertura, NTNU Social Research, Dragvoll Allé 38 B, 7491 Trondheim, Norway
[b] SINTEF Technology and Society, Safety and Reliability, NO-7455 Trondheim, Norway
[c] Safety Science Group, Delft University of Technology, Netherlands
[d] Hastam, UK

Some good things – moving away from error

- Shifting the emphasis away from the ‘bad apple’ theory of accident
- Blame cultures -> Just cultures
- Focus on safety as it happens (‘work as imagined’ vs. ‘work as happens’) – back to 1973 ☺

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Summary

- Many exciting developments
- Many (if not all) can be traced back to Riso and Rasmussen
- Rather than seeing them as in opposition, view them ('pragmatically') as complementary
- Lots of work there out to be done (not least in terms of theory)
- Let's move away from slogans
- Synthesis work, but please don't forget practice!
- And finally ….

We live in interesting times .. But …

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We live in interesting times .. But …

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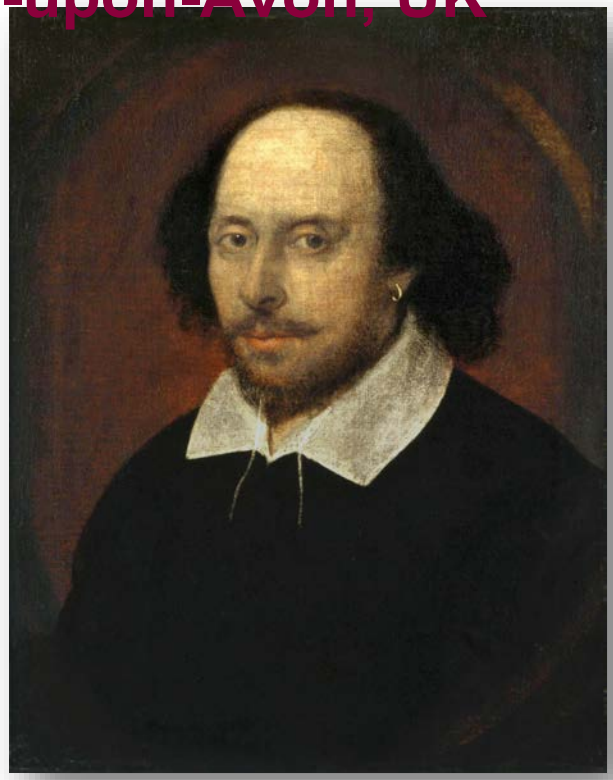
Organizational Design and Management (ODAM 2020)
26th-29th July 2020 Stratford-upon-Avon, UK



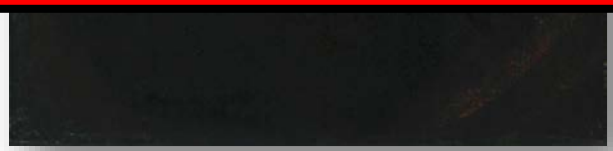
More information:

https://events.ergonomics.org.uk/event/organisational-design-and-management-2020/

Organizational Design and Management (ODAM 2020)
26th-29th July 2020 Stratford-upon-Avon, UK

Thanks for Your Attention!

p.waterson@lboro.ac.uk



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