

Human Factors: A New Approach for Safety and Operational Excellence

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Rio de Janeiro, August 13th, 2019

We work in a high-hazardous industry!

Errors may lead to catastrophic consequences!



"Human Error"

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Demystifying "Human Error"

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- Why cannot a perfect procedure exist?
- Why one set of corrective actions works for some people and not for others?
- Is complacency a choice?



The Traditional Approach

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Old View of Human Factors

(Behavior-Based Safety / Safety-I)





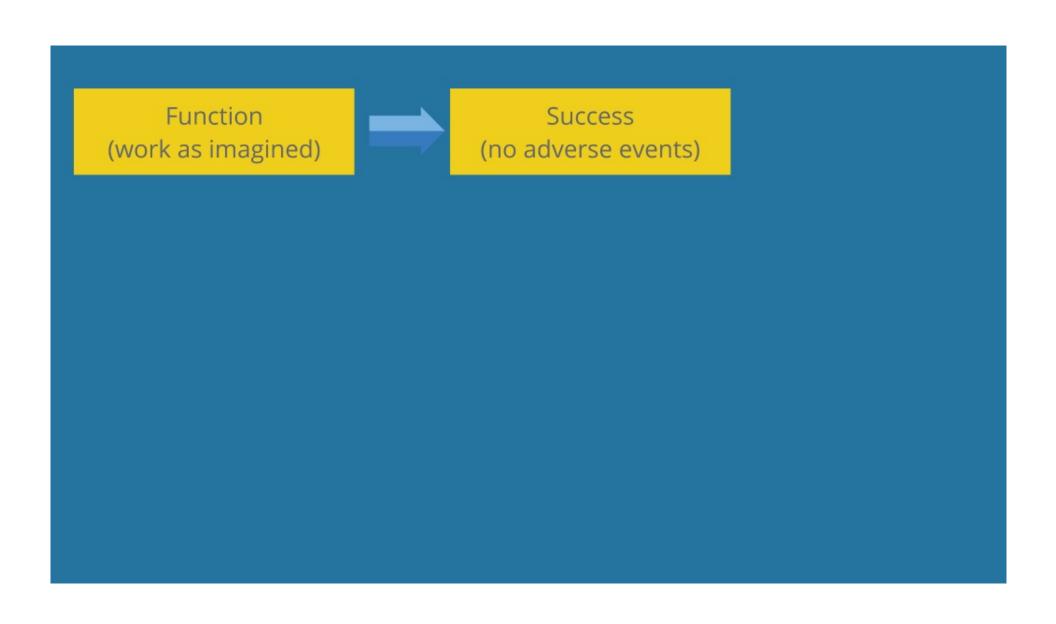
- 'Human error' is the cause of accidents
 - Therefore, failures are explained in the form of 'errors', mistakes, violations commited by the frontline workers

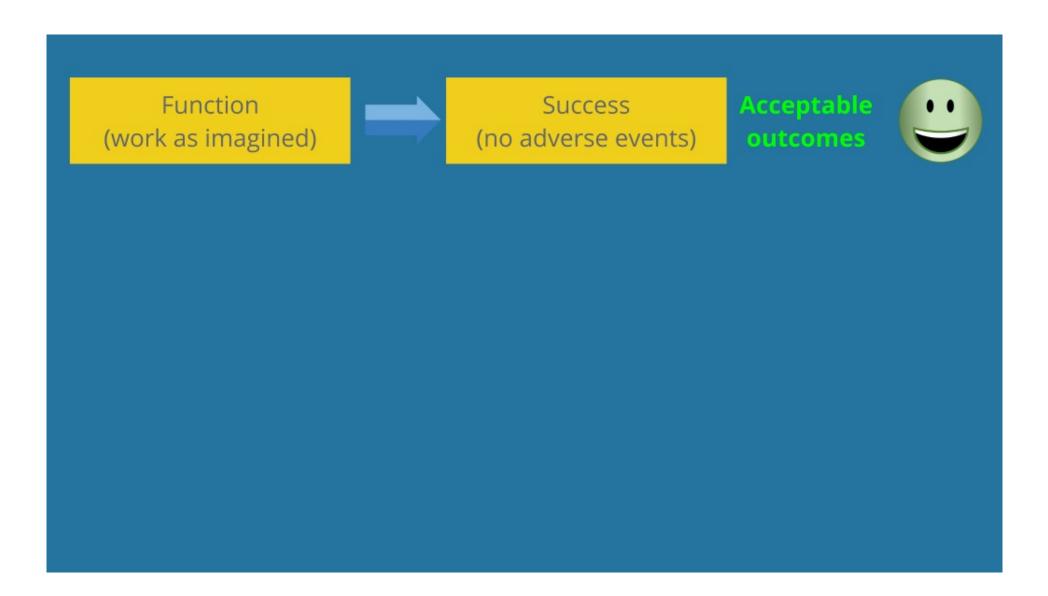
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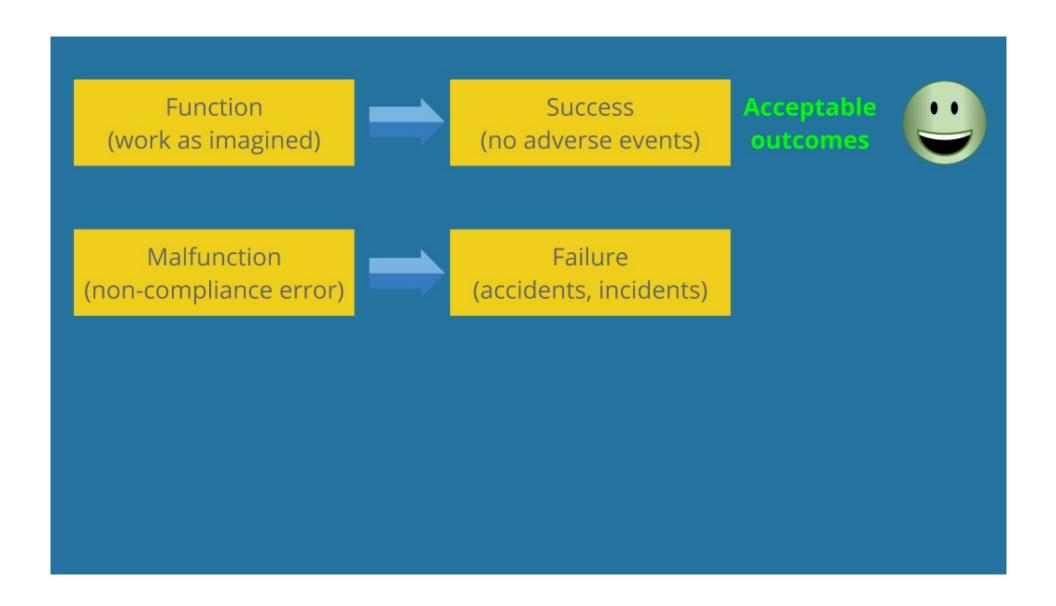
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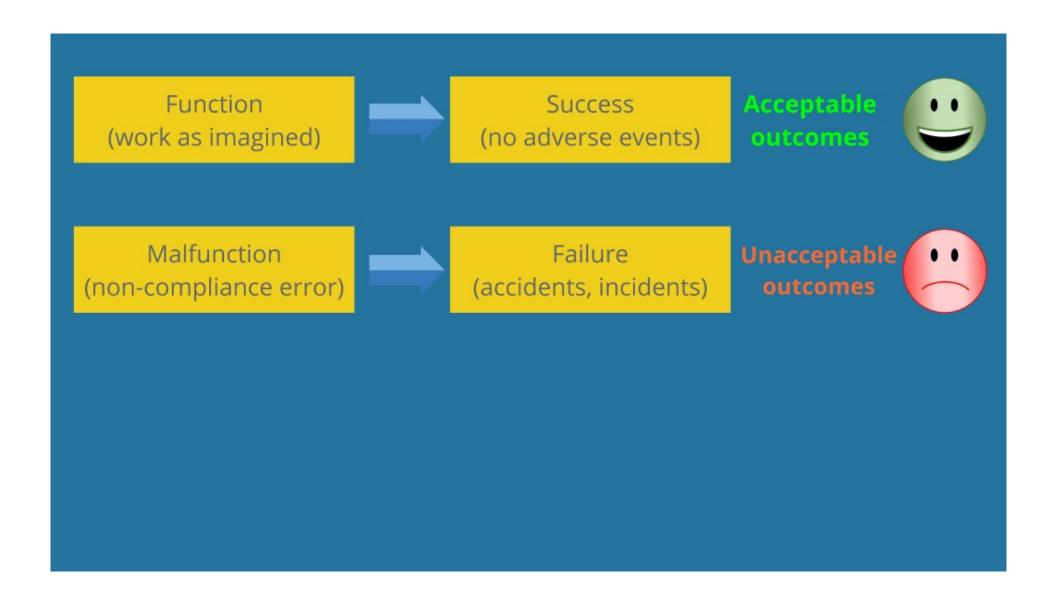
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 - People are custodians of already safe systems. They just need to do as they're told.
- Zero errors, zero injuries, zero accidents are goals we can, and must, achieve.



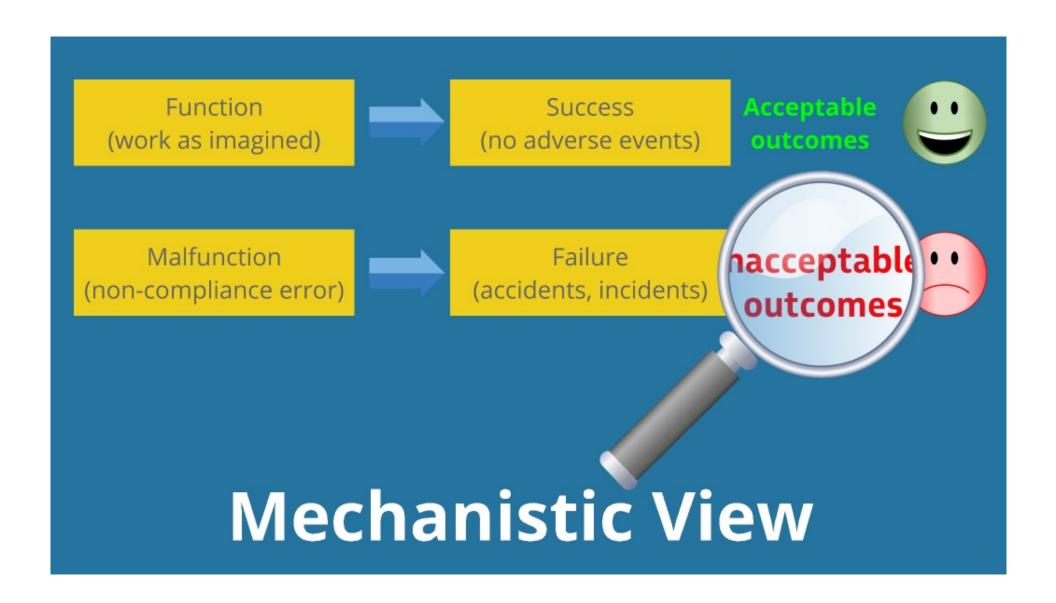










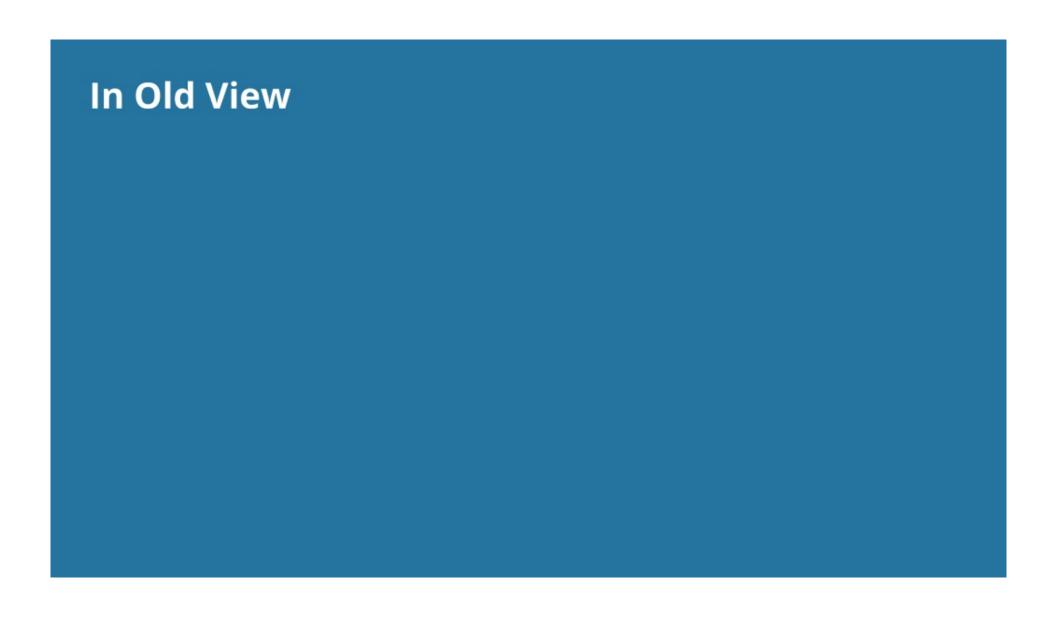


Mechanistic View

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Failures (either safety or operational) are the result of the erratic behavior of unreliable people in an otherwise reliable system







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In Old View

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- Safety is improved by protecting the system from the erratic humans through selection, training, procedures, protocols, automation, and discipline
- Bad behavior is a personal problem, an issue of individual choice (the "Bad Apple").

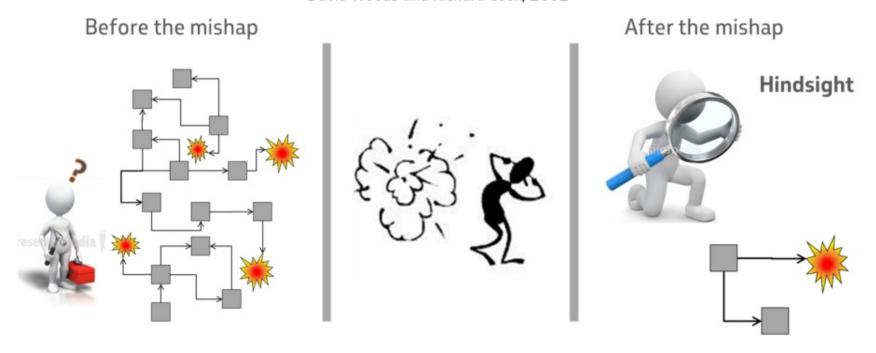


'The past seems incredible, the future implausible'.

David Woods and Richard Cook, 2002

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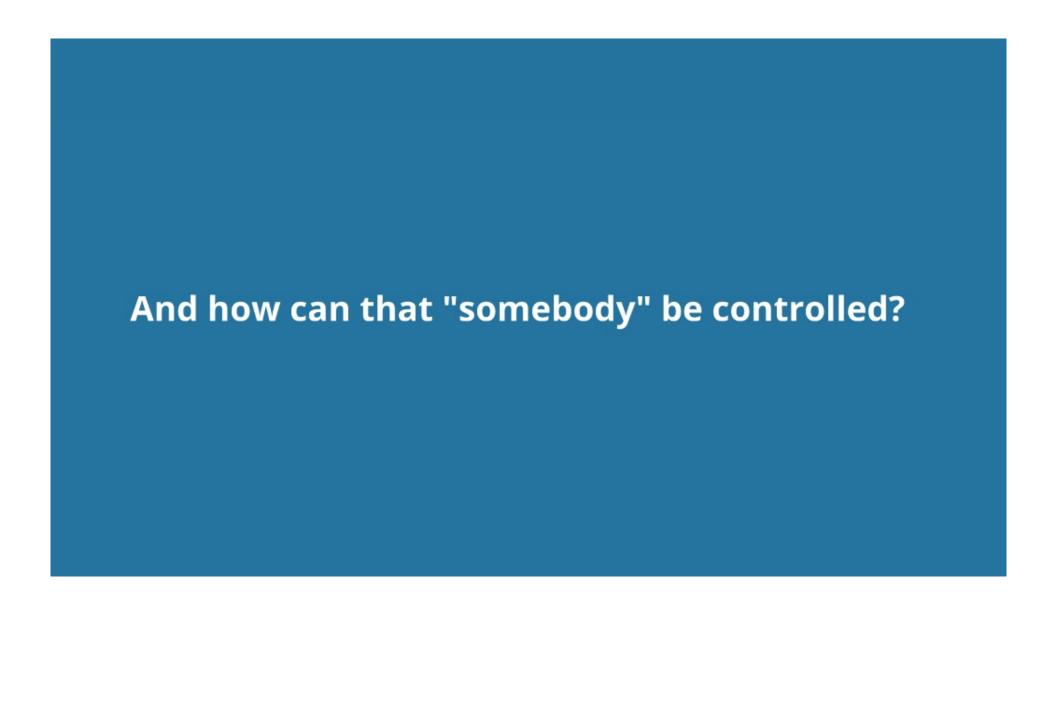
Somebody did not pay enough attention

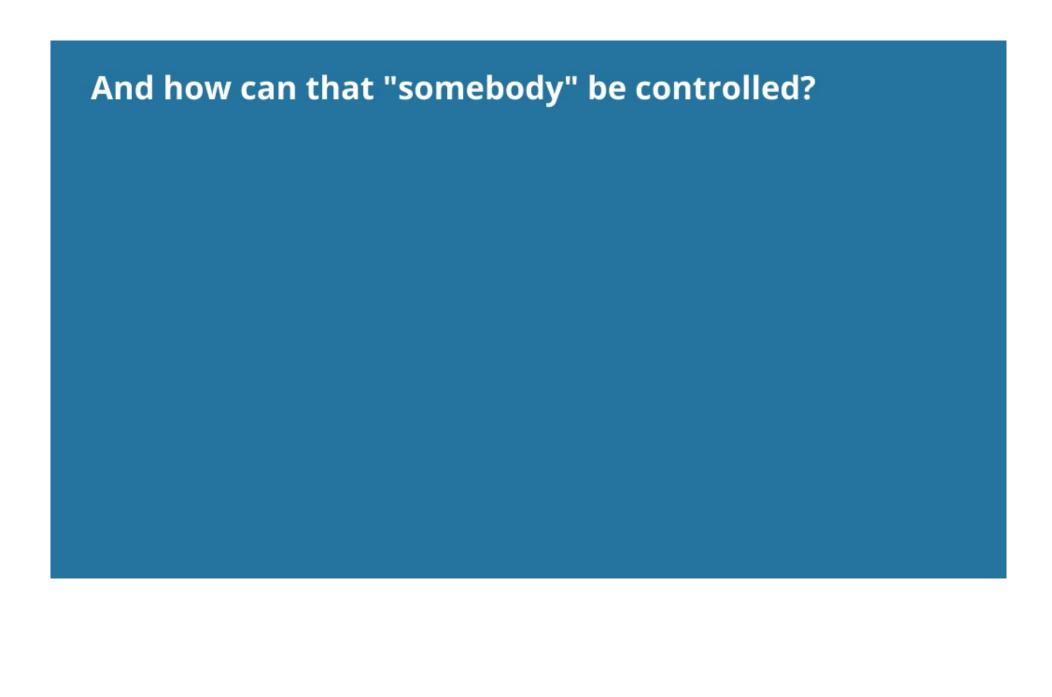
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- Somebody thought that making a shortcut was not a big deal







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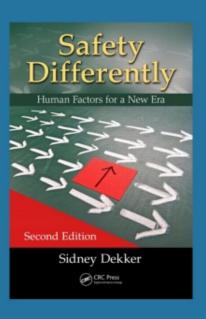
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- Get technology to replace unreliable people



Some effects

- Growing safety bureaucracy
 - No measurable improvements
 - Measuring & managing wrong risks
- Number games
- Disengagement

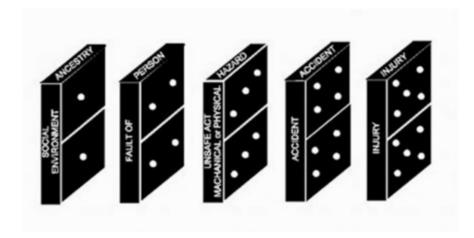




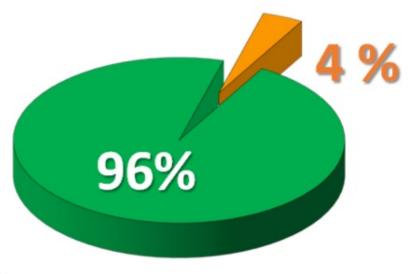


96%

The Heinrich 300-29-1 Model



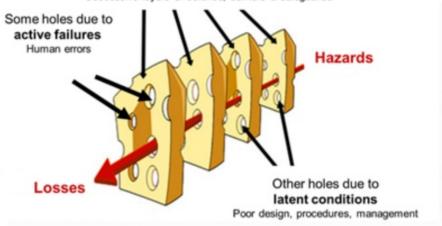


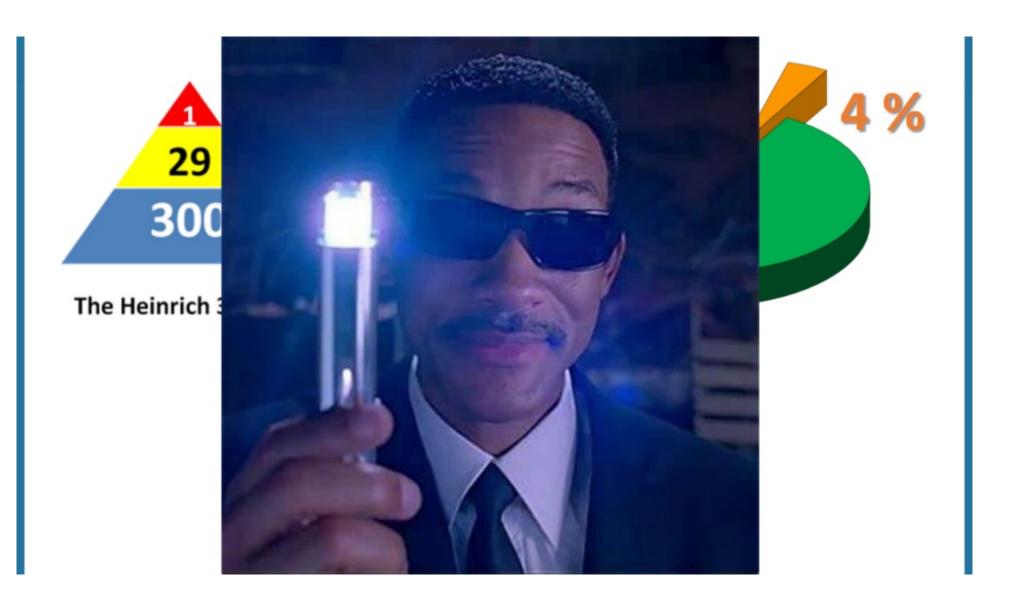


The Heinrich 300-29-1 Model

Levels of defence

Successive layers of defence, barriers & safeguards





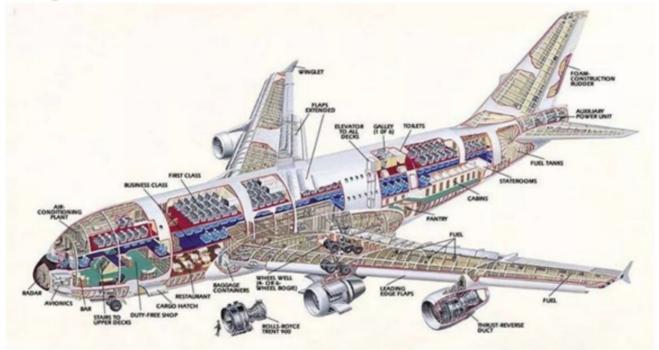


Complex Socio-Technical System



System 1: Complicated

- Knowable
- Tractable
- Measurable
- Predictable
- Controllable



System 2: Complex

- ❖ Not fully knowable
- Intractable
- Semi-Measurable
- Semi-Predictable
- Semi-Controllable



New View of Human Factors

(Resilience Engineering / Safety-II)



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Are people a problem to control?

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Are people a problem to control? Or a resource, a solution, to harness?





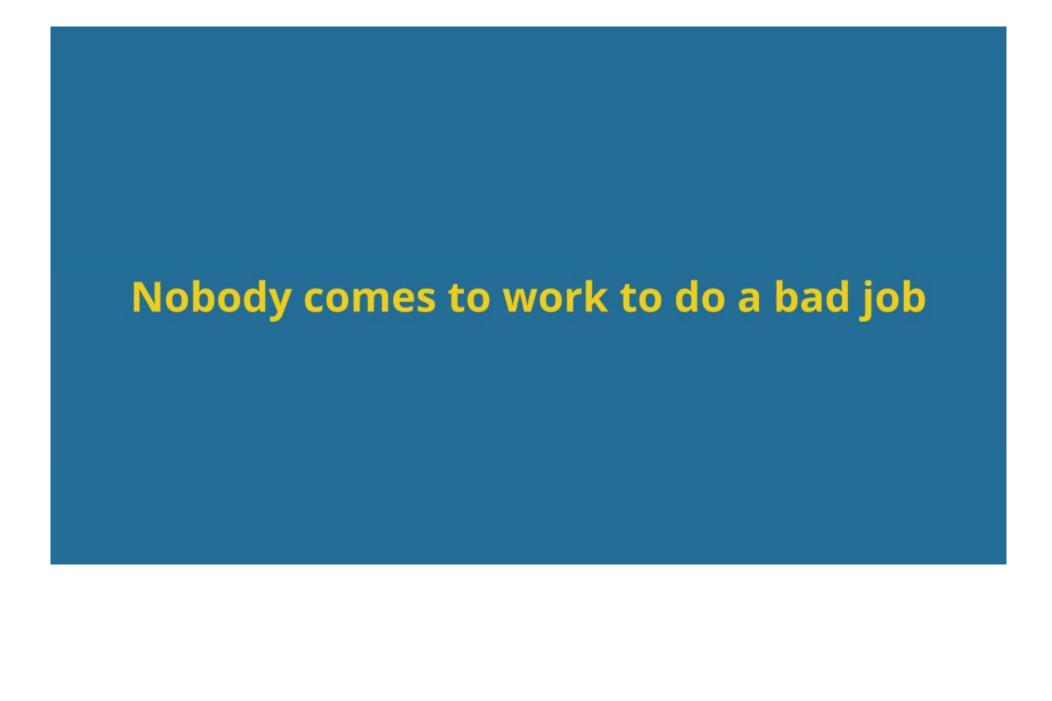
In New View it is understood that

- System is not inherently or automatically safe
 - People create safety through practice

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- System is not inherently or automatically safe
 - People create safety through practice
- People do their best to reconcile different goals simultaneously
 - · Efficiency, production, service, safety







Nobody comes to work to do a bad job But we do!

But we do!

We are a naturally stupid race

- We are a naturally stupid race
- · There might be reasons, a meaning

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- People do reasonable things, given their
 - Goals
 - Knowledge
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Work-as-Imagined vs Work-as-Done



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- Safety is not the absence of negative events, but instead the presence of positive capacities that make things go right

Newtonian Reasoning





Success (no adverse events)

Acceptable outcomes



Malfunction (non-compliance error)



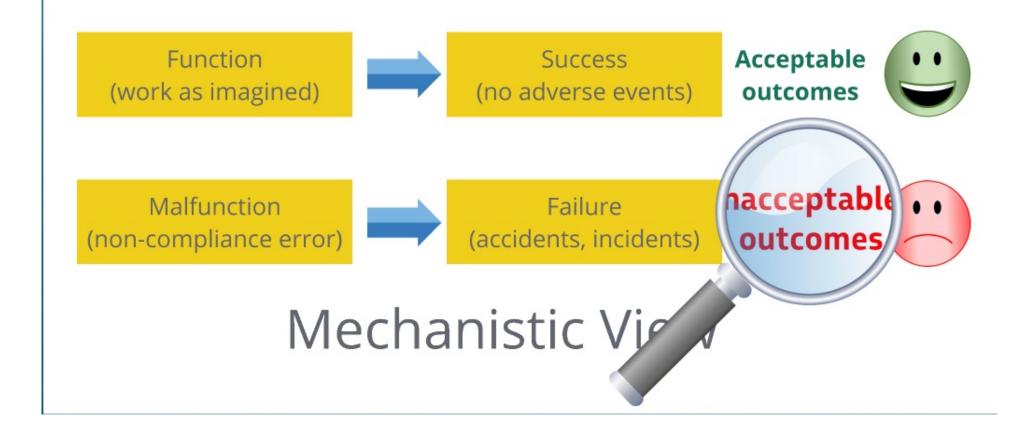
Failure (accidents, incidents)

Unacceptable outcomes



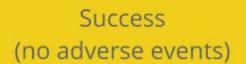
Mechanistic View

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System Approach



System Approach

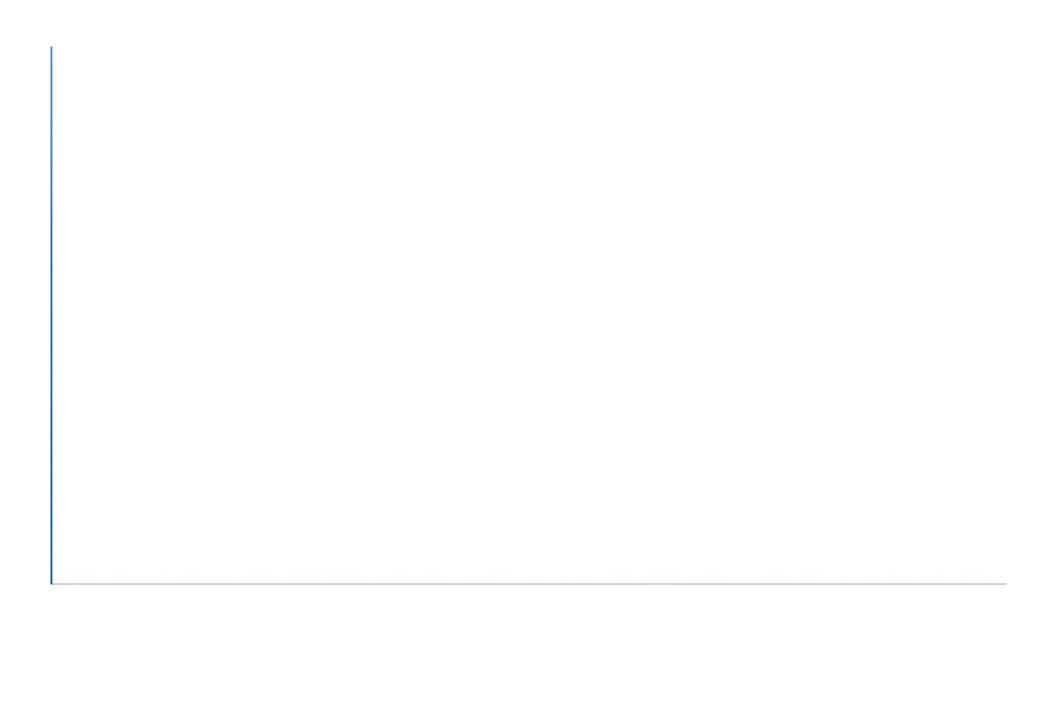


Socio-Technical View

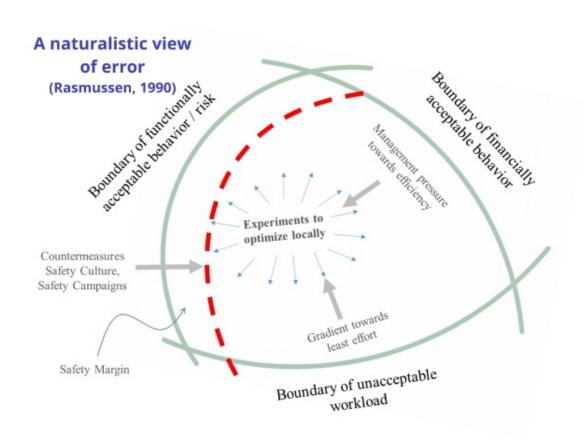
Resilience Engineering

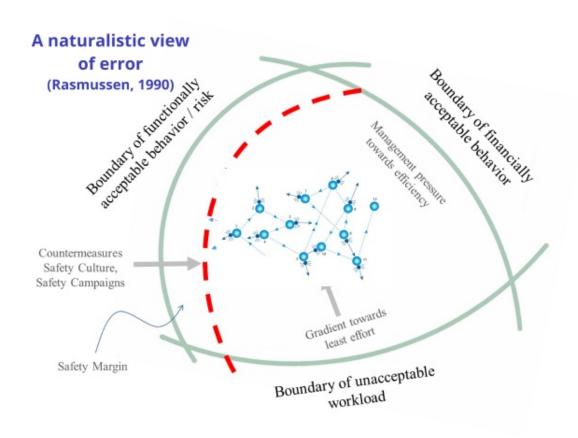


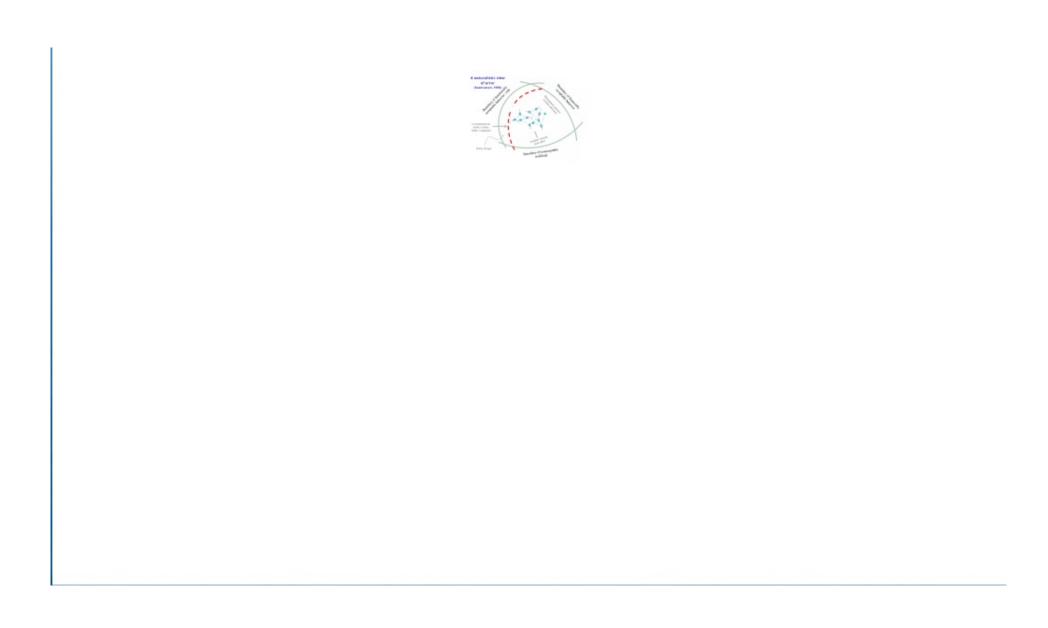
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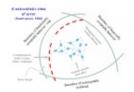














Boundary of acceptable risk / performance



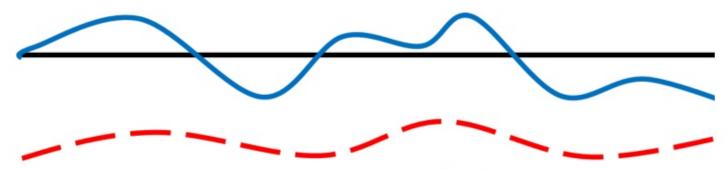
Work as Planned vs. Work in Practice



Boundary of acceptable risk / performance



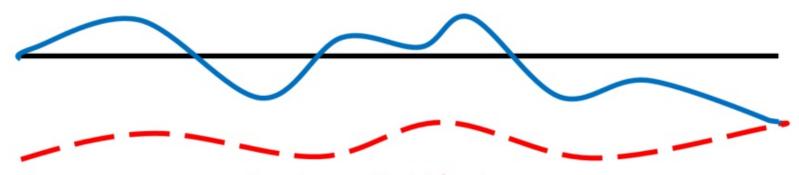
vs. Work in Practice



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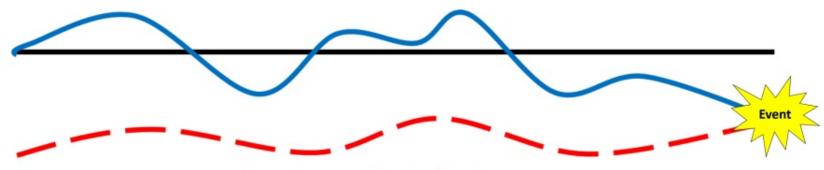
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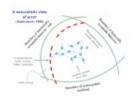


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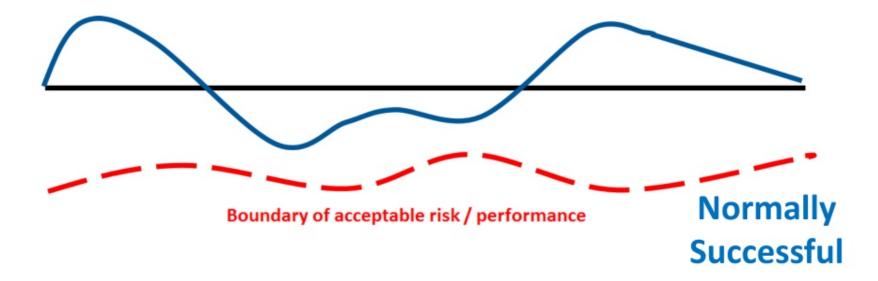


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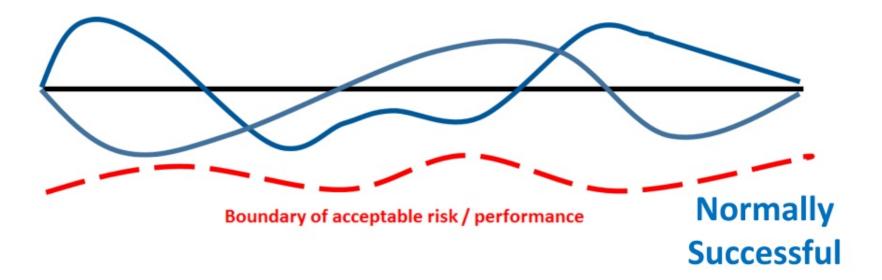


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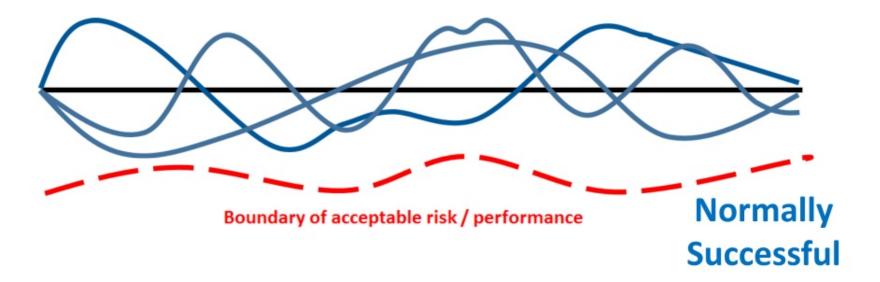


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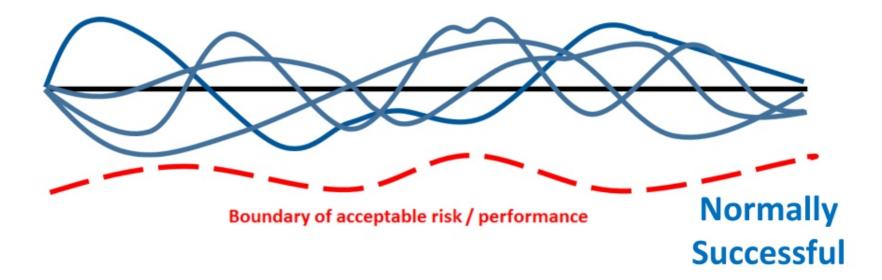


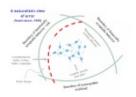
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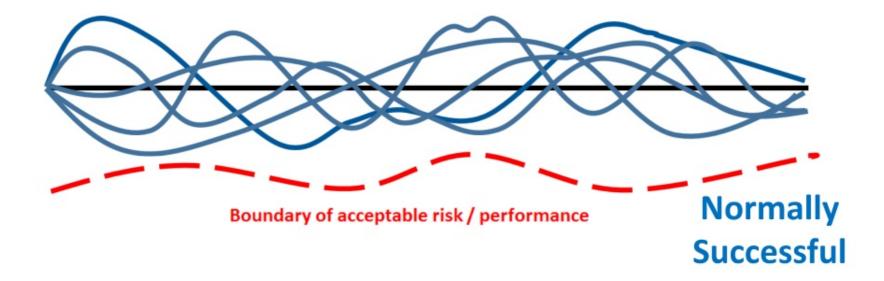


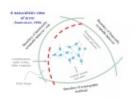
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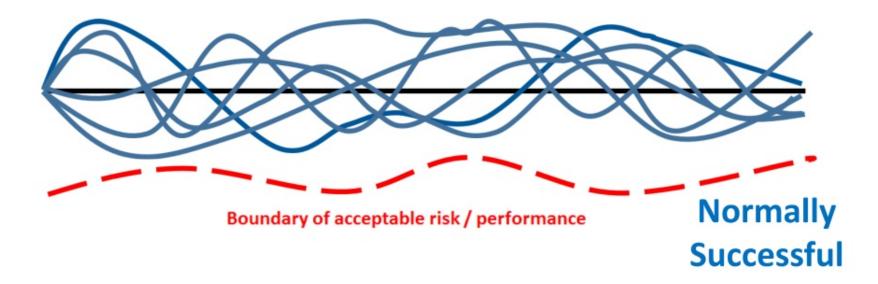


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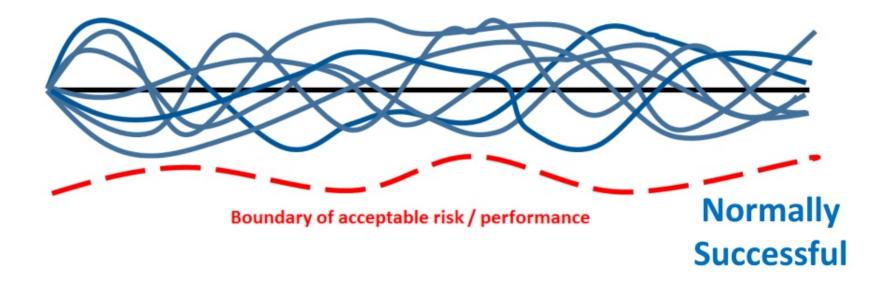


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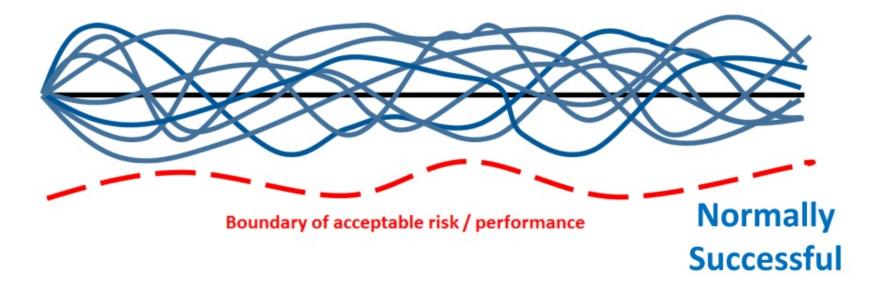


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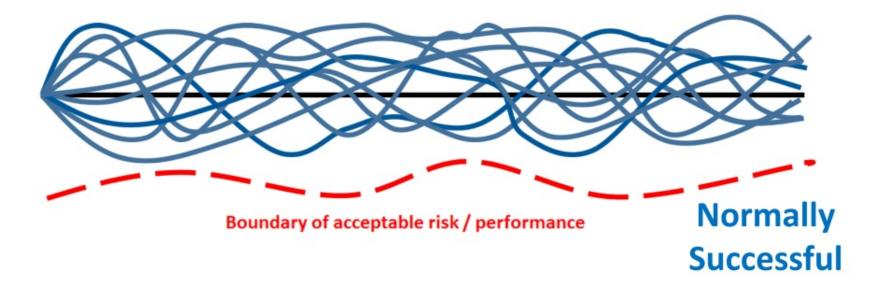


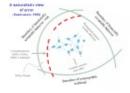
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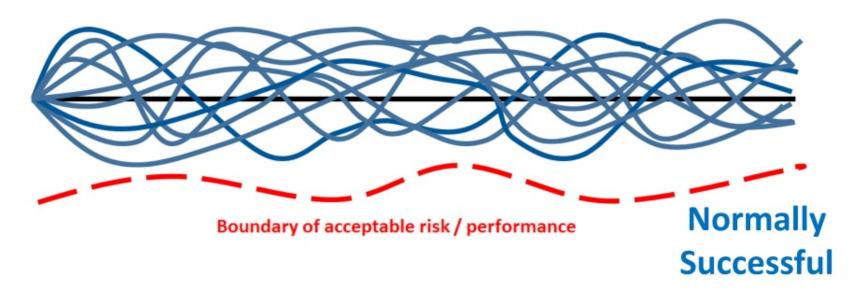
vs. Work in Practice





Work as Planned vs. Work in Practice

"Masters of the blue line"



Human Factors in Practice for Safety and Operational Excellence

70's & 80's













Normal Accidents Theory







Charles Perrow, 1984

Normal Accidents Theory

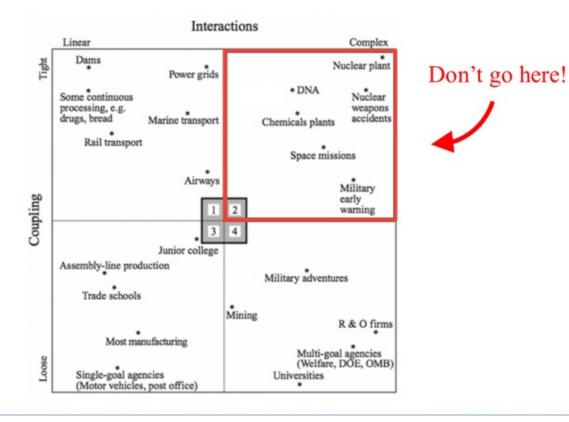
Accidents are inevitable in extremely complex systems, given the residual uncertainty and the possibility of multiple failures to interact with each other.

Charles Perrow, 1984

Increased coupling manage by centralization

Normal Accidents Theory

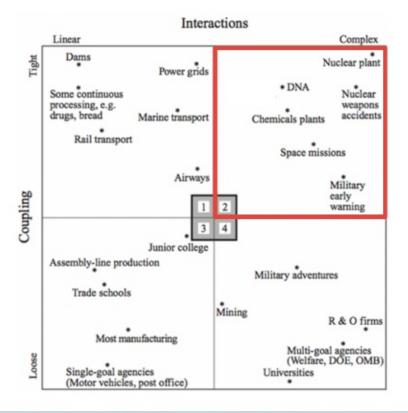
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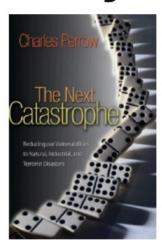
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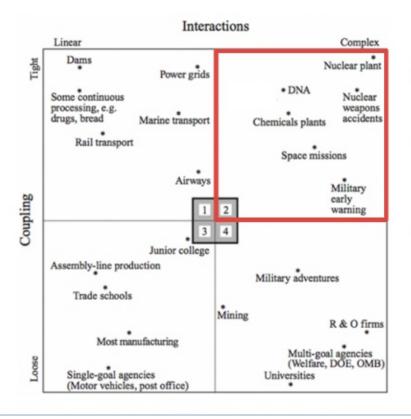




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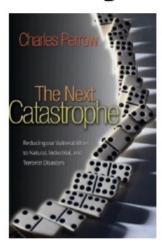
Normal Accidents Theory

Increased complexity manage by decentralization



Don't go here!





"I will argue that deepwater drilling ...
should be abandoned, because it
combines complexity and coupling
with catastrophic potential."

Charles Perrow, 2011

High Reliability Theory

Rochlin et al., 1987

NAVAL WAR COLLEGE REVIEW, AUTUMN 1987

The Self-Designing High-Reliability Organization: Aircraft Carrier Flight Operations at Sea

Gene I. Rochlin, Todd R. La Porte and Karlene H. Roberts

ver I go from bere, I'll never have a better job

R ecent studies of large, formal organizations that perform complex, inherently hazardous, and highly technical tasks under conductions of tight coupling and severe time pressure have generally concluded that most will fail spectacularly at some point, with attendant human and social costs of great severity. The notion that accidents in these systems are "normal," that is, to be expected given the conditions and risks of operation, appears to be as purely accounted in the conditions and risks of operation, appears to be as well-grounded in experience as in theory. Yet, there is a small group of organizations in American society that appears to succeed under trying organizations in American society that appears to succeed under trying circumstances, performing daily a number of highly complex technical tasks in which they cannot afford to "fail." We are currently studying three



High Reliability Organizations

 Organizations exceptionally consistent in accomplishing their goals and avoiding catastrophes (Roberts et al, 1980s)

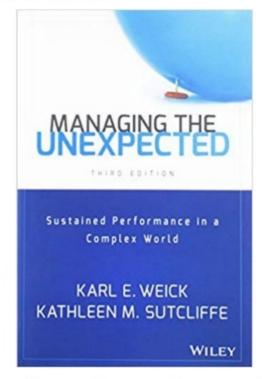
 They are proven not to be error free, but "catastrophes almost free"

Normal Accidents in Highly Reliable
 Organizations (Sagan, 1993; Snook, 2000)



Some Traces of HRO

- 1. Preoccupation with failures
- 2. Reluctance to simplify
- 3. Sensitivity to operations
- 4. Commitment to resilience
- 5. Deference to expertise

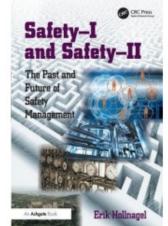


Reference: Weick, K.E. & Sutcliffe, K.M. 2007. Managing the Unexpected: Resilient Performance in an Age of Uncertainty. 2nd Ed. San Francisco, CA: Jossey-Bass

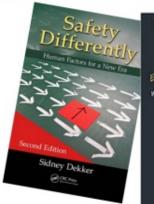
RESILIENCE ENGINEERING

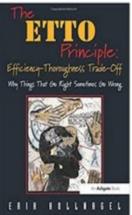
Principles:

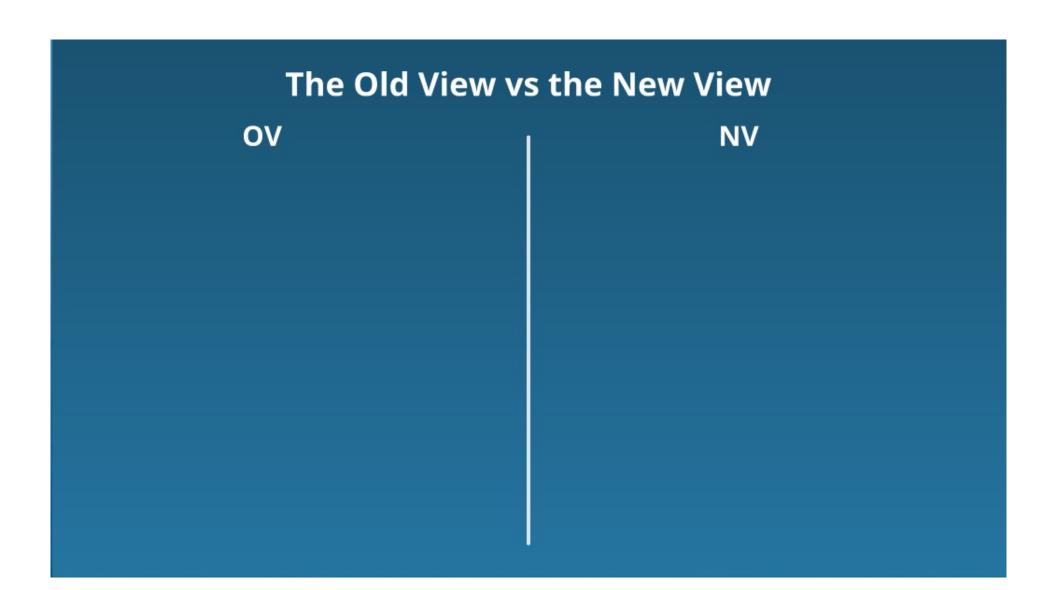
- 1. Humans create safety in systems
- 2. Deference to learning and expertise
- 3. Work-as-imagine Versus Work-as-done
- 4. World of multiple competing trade-offs
- 5. Successes and failures have similar roots
- 6. Success and local efficiency incubates accidents
- 7. Participation by interest rather than by conformity











OV I NV

Accidents are caused by human error

Human error is a sympton of bigger problems deep inside the system

OV

Accidents are caused by human error

Safety as the absence of negative events

NV

Human error is a sympton of bigger problems deep inside the system

Safety as the presence of positice capacities, capabilities and competencies (resilience)

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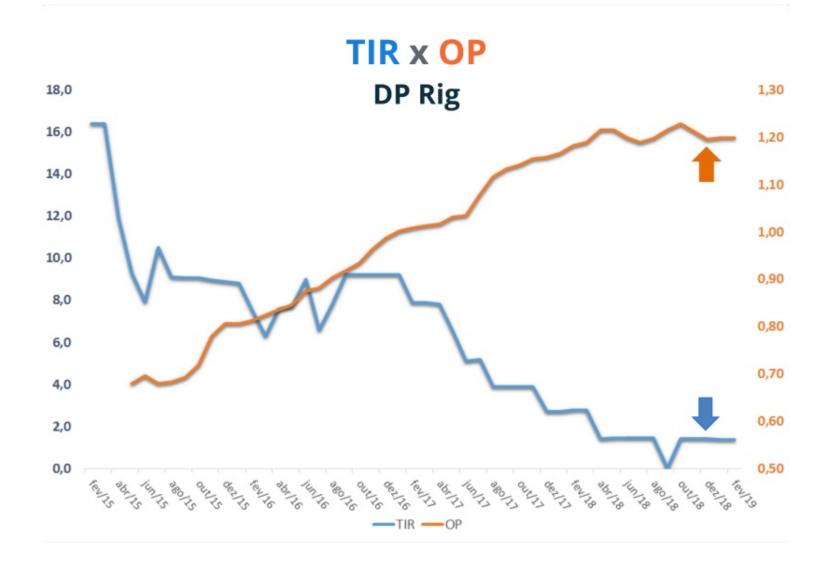
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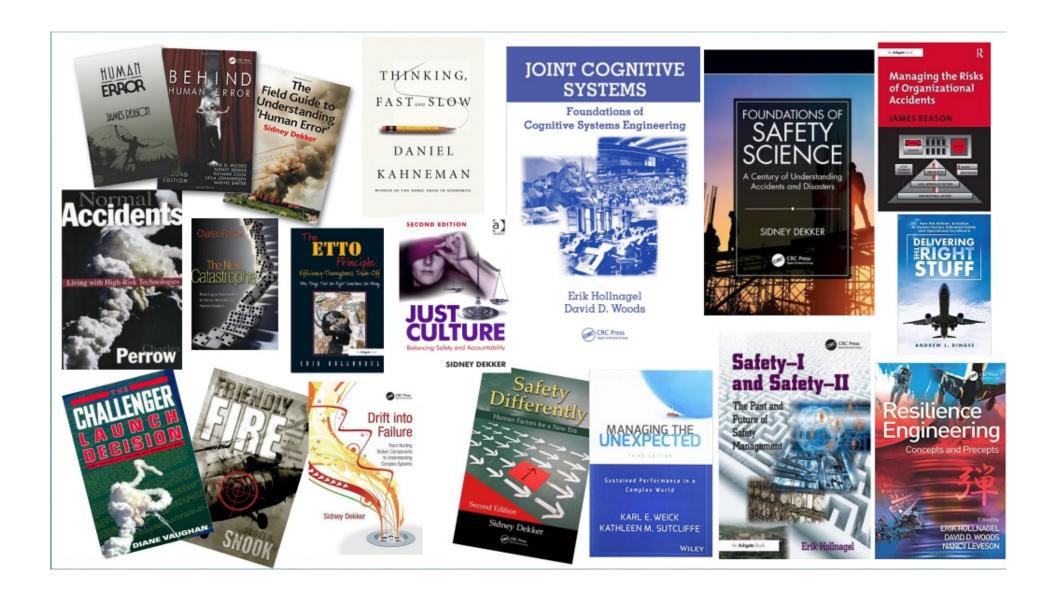
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Thank you!

José Carlos Bruno

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Human Factors: A New Approach for Safety and Operational Excellence

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Rio de Janeiro, August 13th, 2019