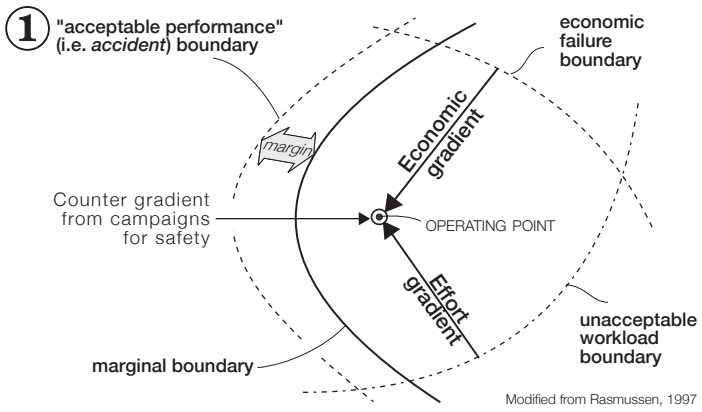
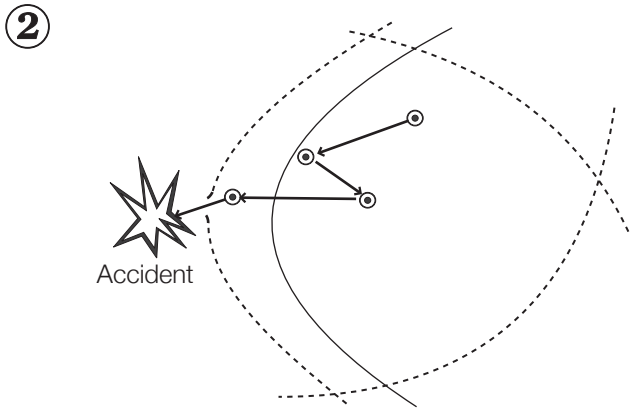
A brief look at Going Solid and the Dynamics of Safety



Work takes place in a space with economic, workload, and "acceptable performance" boundaries.

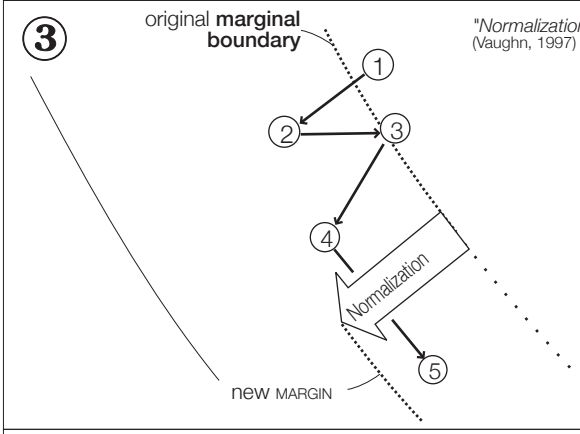
Management pressure for economic efficiency and the consequences of workload create *gradients* that push the operating point towards the acceptable performance boundary.

The marginal boundary is the rules, policies, and regulations. "Normal" operations stay within the marginal boundary.



Crossing the marginal boundary is an *incident*. Punching through the acceptable performance boundary is an *accident*. Incidents are common, accidents are rare.

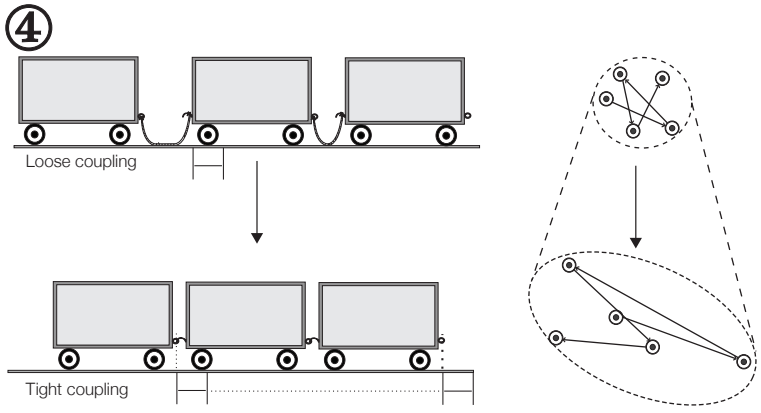
The operating point (OP) is *dynamic*; it moves as conditions change. Most movements are small and many are predictable. Organizations can adjust resources to make offset regular movements. This can make the OP the location appear stable over time.



Crossing the margin (1 to 2) is treated as a violation and produces effort to return operations to the "normal" (2 to 3).

Repeated margin crossing (3 to 4) without accident leads to the belief that operating there is "normal". The marginal boundary may shift *even though the acceptable performance boundary has not moved*.

The "new normal" may not seem dangerous!



	***Loose** coupling*	***Tight** coupling*
Delays	Tolerated	Not-tolerated
Sequences	Changeable	Fixed
Methods	Multiple	One-or-few
Substitution	Available	Absent
Slack	Designed-in	Fortuitous
Buffers	Designed-in	Fortuitous

Modified from *Normal Accidents* Perrow, 1984

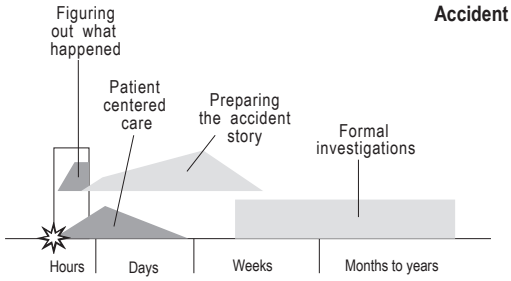
Highly efficient systems can shift suddenly from loose to tight coupling. This makes the normally predictable and small movements of the OP become unpredictable and large.

If the OP is already near the acceptable performance boundary...

Rev. C
(06.07.15)

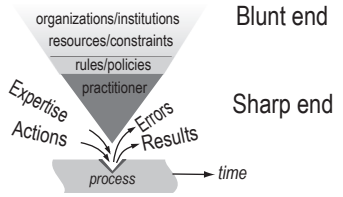
A brief look at the New Look in complex system failure, error, safety, and resilience

① Accident Aftermath



Accident investigation normally concludes that *human error* by practitioners was the 'cause' of the event.

② The Sharp End

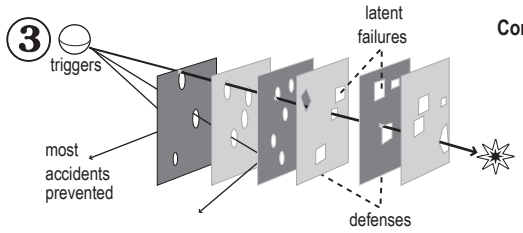


Modified from Woods, 1991

Practitioners work at the *sharp end* of the system.

The *blunt end* of the system generates resources, constraints and conflicts that shape the world of technical work and produce *latent failures*.

③ Complex System Failure

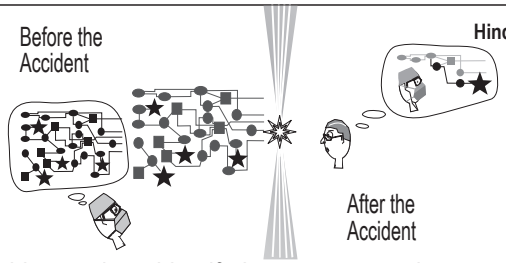


Modified from Reason, 1990

Complex systems fail because of the combination of multiple small failures, each individually insufficient to cause an accident.

These failures are *latent* in the system and *their pattern changes over time*.

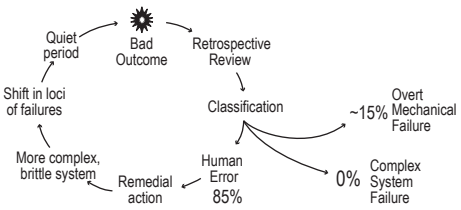
④ Hindsight Bias



Post-accident reviews identify *human error* as the 'cause' of failure *because of hindsight bias*.

Outcome knowledge makes the path to failure seem to have been foreseeable - although it was not foreseen.

⑤ Cycle of Error

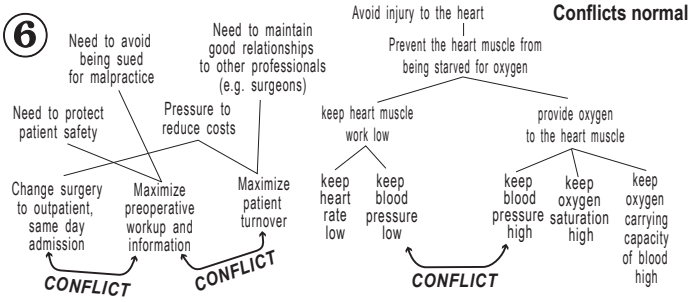


Organizational reactions to failure focus on *human error*.

Common reactions: blame & train, sanctions, new regulations, rules, and technology.

These interventions increase complexity and introduce new forms of failure.

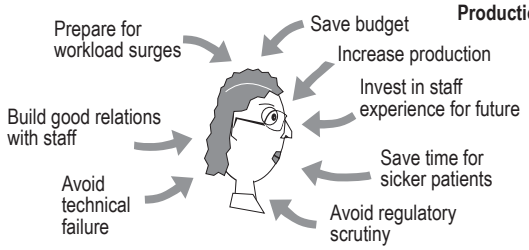
⑥ Conflicts normal



Competing demands, dilemmas, conflicts, and uncertainty are the *central features* of operations at the sharp end.

Organizational and technical conflicts overlap and interact.

⑦ Production pressure



Work at the sharp end inevitably encounters competing demands for production and failure-free performance.

Action resolves all dilemmas.

Successful operations are the rule. Failure is rare.

⑧ Resilience

People *make* safety. Sharp end work bridges gaps & prevents or minimizes failures. These activities form much of technical work. The result is systemic ***resilience.*** Productive approaches recognize, appreciate & support these activities.

Revision CC
06.07.15