Perceiving What Cannot Be Seen: the Practical Side of Safety-II

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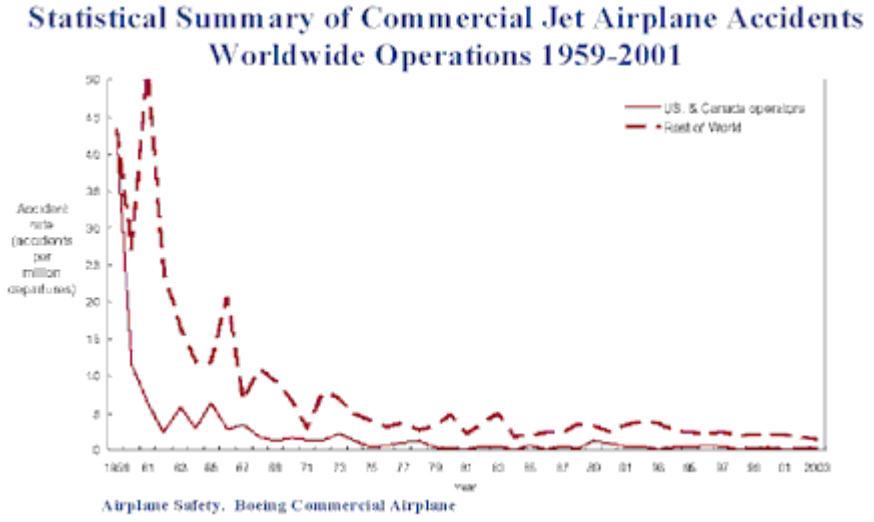
Thinking about safety

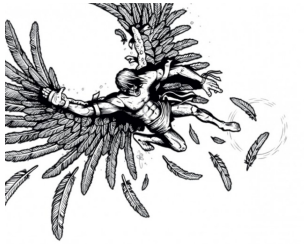
When we think about safety, we usually think about accidents – about (low probability) events with adverse outcomes.

A system is safe if as little as possible goes wrong.



We need to be safe and to feel safe

Safe tysyn thesis



Accidents, incidents, breakdowns, disruptions.

A need to be safe (explanations)

A need to feel safe (assurances)

"Acts of god" → Technical failures → Human Factors → Safety culture → Complex systems

When looking for explanations, we have a preference for single (monolithic) causes

A brief history of safety

1802	Coal Mines Act
1833	HM Factory Inspectorate Act
1872	Mines Act
1875	Explosives Act
1878	Threshing Machines Act
1923	National “Safety First” Association
1941	Royal Society for the Prevention of Accidents

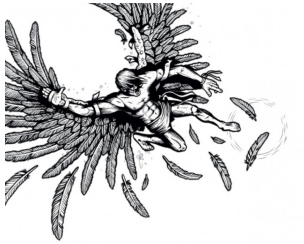
1975	Health and Safety Executive (HSE)

Act for the preservation of the Health and Morals of Apprentices and others employed in Cotton and other Mills, and Cotton and other Factories

1950s	USAF System Safety Engineering
1964	USAF Military Specification for Safety - MIL-S-38130

2006	ICAO Safety Management System Standard

We need to be safe and to feel safe



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PRAY

REPAIR

BLAME

PAY

PRAY

When looking for explanations, we have a preference for single (monolithic) causes

The causality credo

(1) Adverse outcomes happen because something has gone wrong (causality + value symmetry).
(2) Causes can be found and treated (rational deduction).
(3) All accidents are preventable (zero harm).

"Zero Accident Mindset"

All accidents, injuries, and occupational risks are preventable.

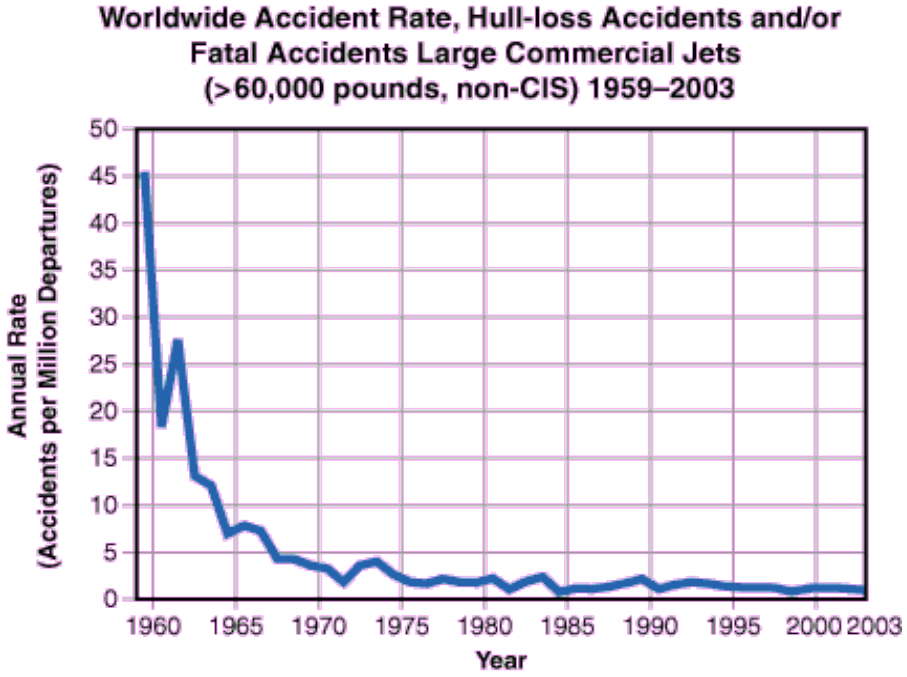
"No repeats"

All adverse outcomes are investigated to find out what happened and why.

"Simple and non-negotiable standards"

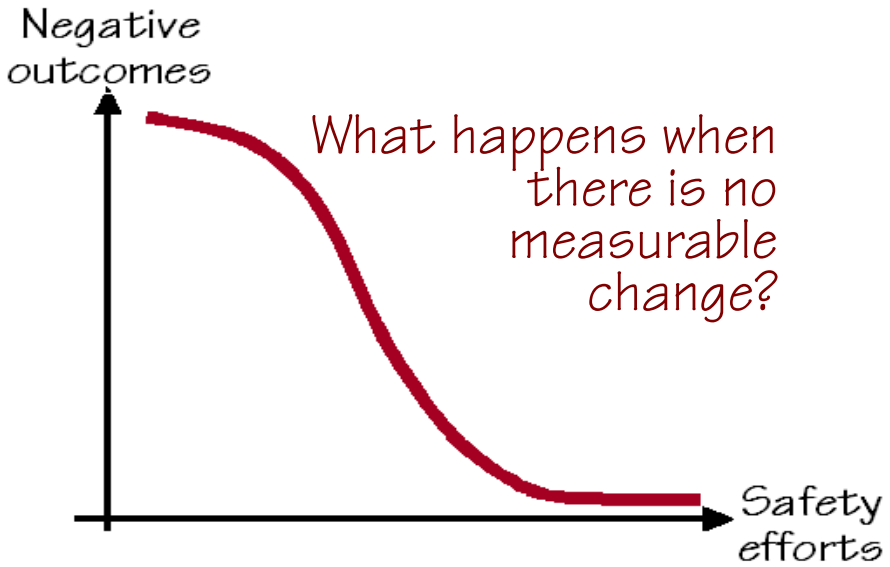
Define and enforce a common, simple set of standards.

Safety as risk reduction



Safety is normally measured by the *absence* of negative outcomes.
This can be achieved in three different ways:
- *eliminating* hazards (design),
- *preventing* initiating events (constraints)
- *protecting* against consequences (barriers)

The purpose of safety management is to *maintain* normal operations by *preventing* disruptions or disturbances. Safety efforts are usually driven by what has happened in the past, and are therefore *reactive*.



Different process ➡ different outcome

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Function (work as imagined) ⟶ Success (no adverse events) — Acceptable outcomes

Hypothesis of different causes: Things that go right and things that go wrong happen in different ways and have different causes

Malfunction, non-compliance, error ⟶ Failure (accidents, incidents) — Unacceptable outcomes

Safety-I – freedom from danger or harm

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ICAO - "... the state in which the risk of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management."

Safety-I is defined by its opposite – by the lack of safety (accidents, incidents, risks).

The premise for Safety-I is the need to understand why accidents happen.

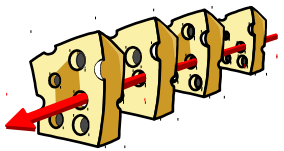
Accidents and incidents are situations that, by definition, lack safety.

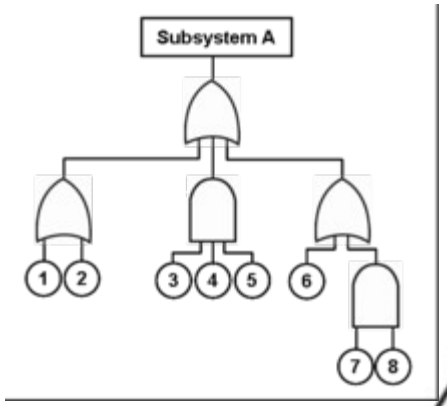
If we want something to increase, why do we use a proxy measure that decreases?

How can we improve safety by studying situations where there is NO safety?

Safety-I: Analysis of failures

Focus on what goes wrong. Look for failures and malfunctions. Try to eliminate causes and improve barriers. Learn from accidents and incidents.





Legal / regulatory requirements: Yes
Organisational functions and roles: Yes
Models and methods: Yes
Formal terminology: Yes
Experts and consultants: Yes
Literature (books & papers): Yes
Databases: Yes

Things that go wrong

Unwanted outcomes

Planned outcomes

Positive surprises

What should we be looking for?

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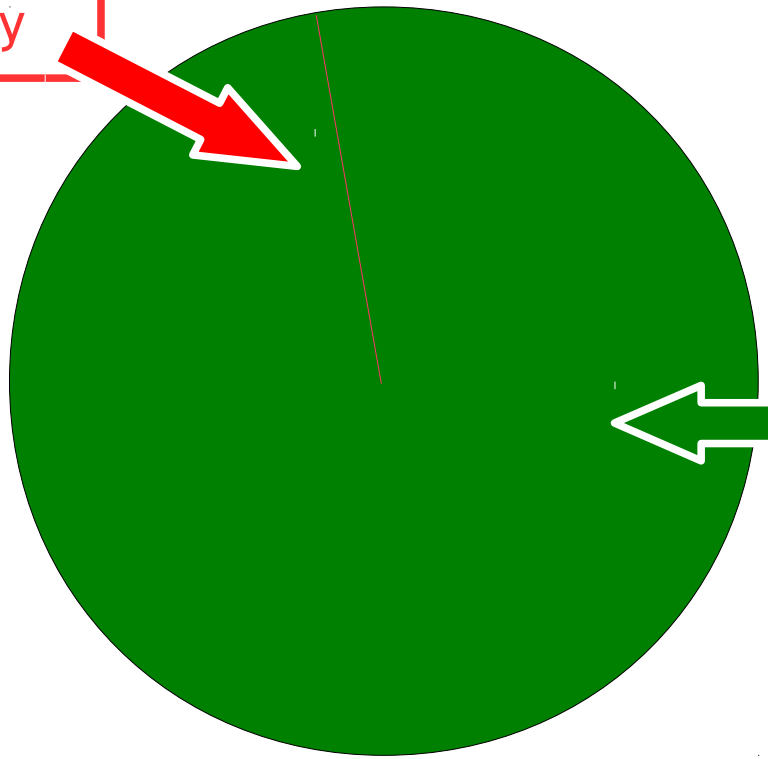
10^{-4} := 1 failure in 10.000 events

Adverse outcomes =
Absence of safety

Easy to see
Complicated aetiology
Difficult to change
Difficult to manage



'Difficult' to see
Uncomplicated aetiology
Easy to change
Easy to manage

Intended outcomes =
Presence of safety

1 - 10^{-4} := 9.999 "successes"
in 10.000 events

"Work-as-imagined" and "work-as-done"

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Design (tools, roles, environment)

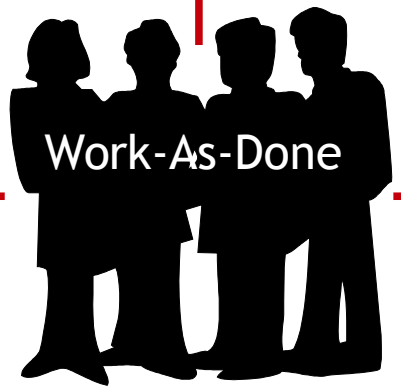
Work-As-Imagined

Work & production planning ("lean" - optimisation)

Work-As-Imagined

Safety management, investigations & auditing

Work-As-Imagined



And now over to Maria ...

Blood transfusion: WAI ≠ WAD

1 REQUEST

2* SAMPLE

3 SAMPLE RECEIPT

4 TESTING

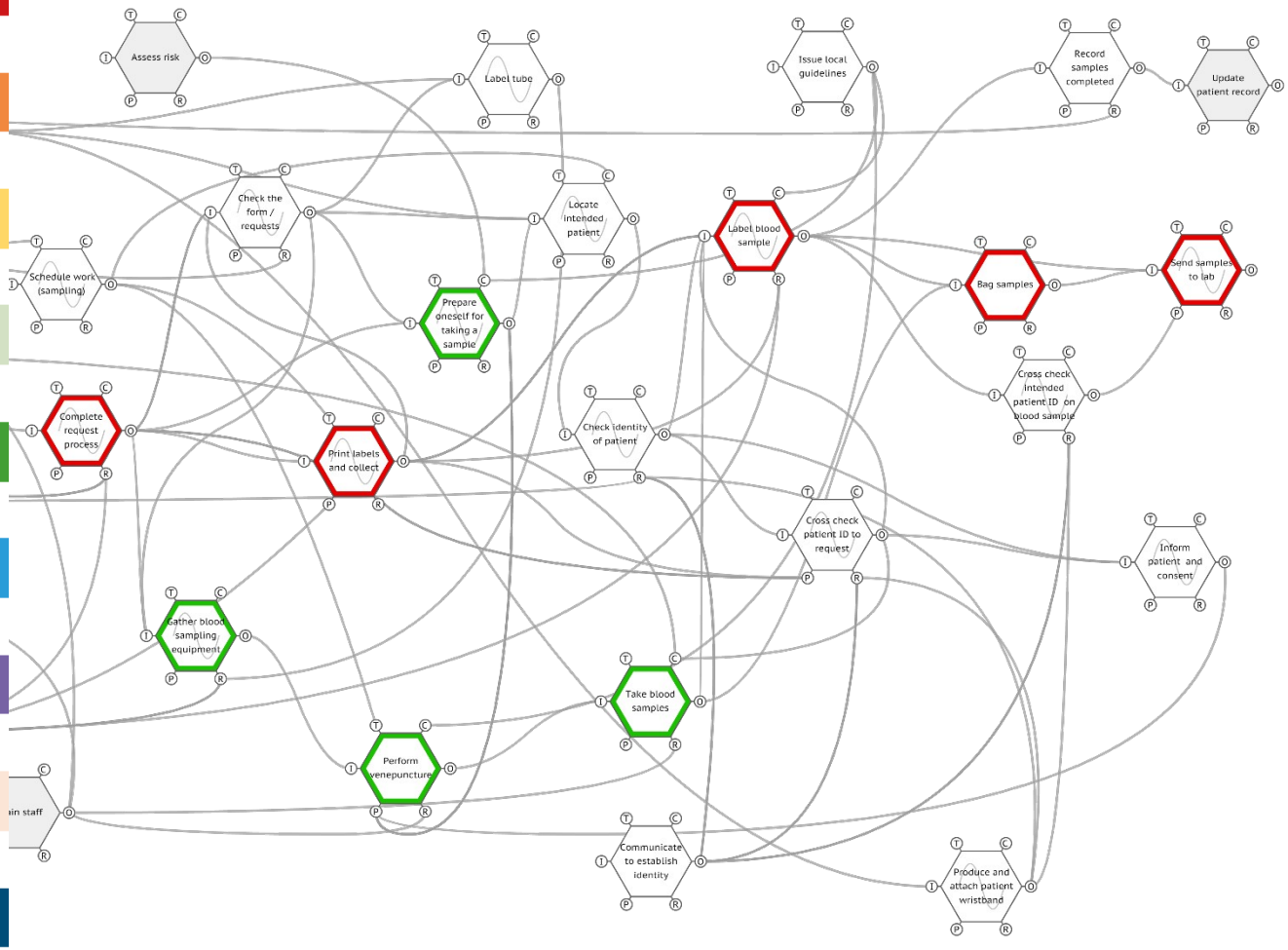
5 COMPONENT SELECTION

6 LABELLING

7 COLLECTION

8 PRESCRIPTION

9* ADMINISTRATION



Wrong Blood in Tube (WBIT)

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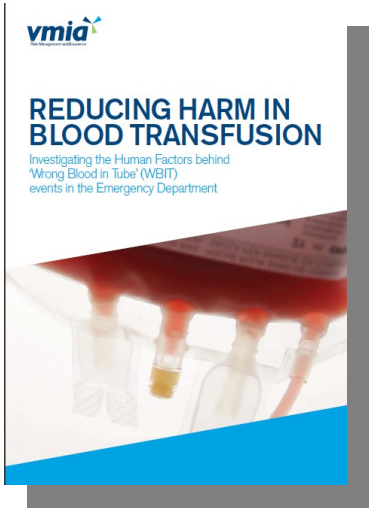
WBITs are estimated to occur at a rate of approximately 1 in 2.000 samples. Main causes are:

- labelling of sample tubes away from the bedside
- failure to check patient identity
- similar names (together with incorrect identity checks)
- use of pre-printed labels
- confusion of patient notes and/or request forms
- inaccurate verbal instructions/no request form



Environment (3 recommendations)
Staff (9 recommendations)
Equipment (12 recommendations)
Patient (2 recommendations)
Procedure (6 recommendations)
Culture (8 recommendations)

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(These recommendations) will provide input for those responsible for reducing errors related to mislabelling and miscollection of blood samples.
The implementation … should be considered in the broader context of the organisational culture of Australian healthcare.

My god, it's full of stars ...

... but most of it is Dark Matter

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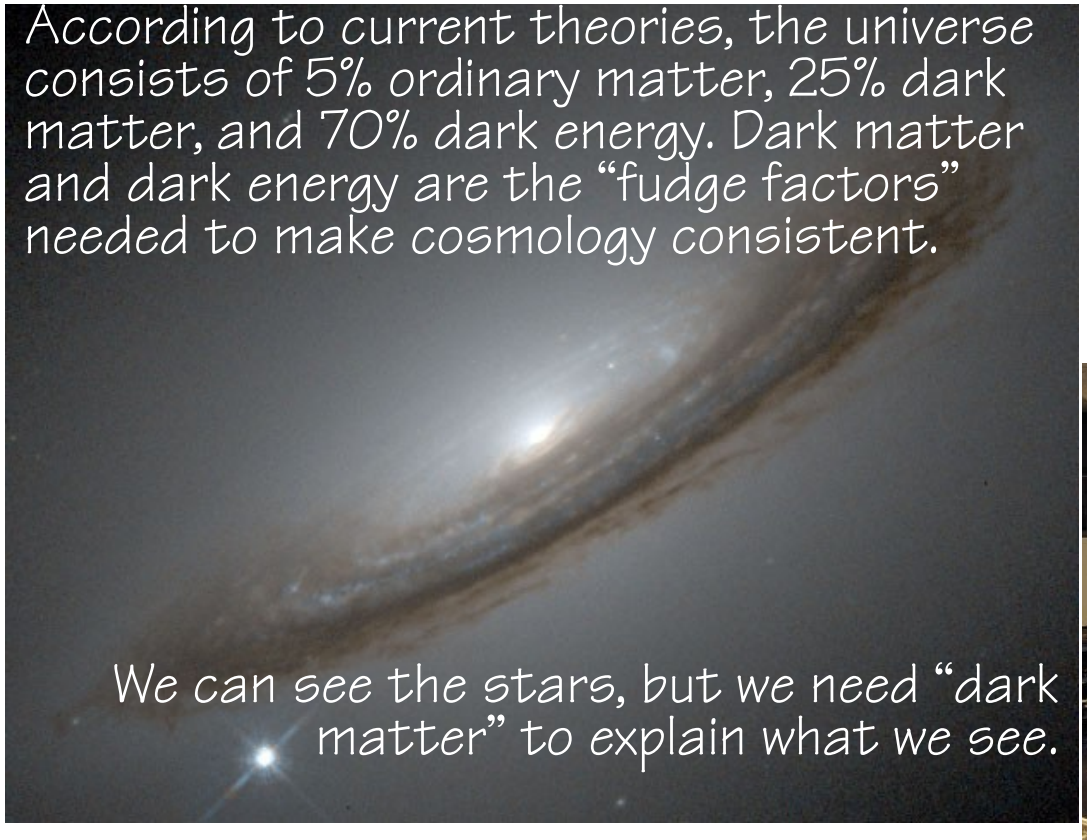
According to current theories, the universe consists of 5% ordinary matter, 25% dark matter, and 70% dark energy. Dark matter and dark energy are the "fudge factors" needed to make cosmology consistent.



We can see the stars, but we need "dark matter" to explain what we see.

In safety management people tend to notice only what goes wrong (the "stars"). But to understand it we need also to look at the "unknown" background = normal performance.

We can "see" what goes wrong, but we can only understand it against a background of "normal performance".

Same process ➡ different outcomes

Function (work as imagined)

Everyday work (performance variability)

Malfunction, non-compliance, error

Success (no adverse events)

Failure (accidents, incidents)

Acceptable outcomes

Unacceptable outcomes

Safety II – when everything goes right

Safety-II: Safety is a condition where the number of successful outcomes (meaning everyday work) is as high as possible. It is the ability to succeed under varying conditions.

Safety is defined by its presence.

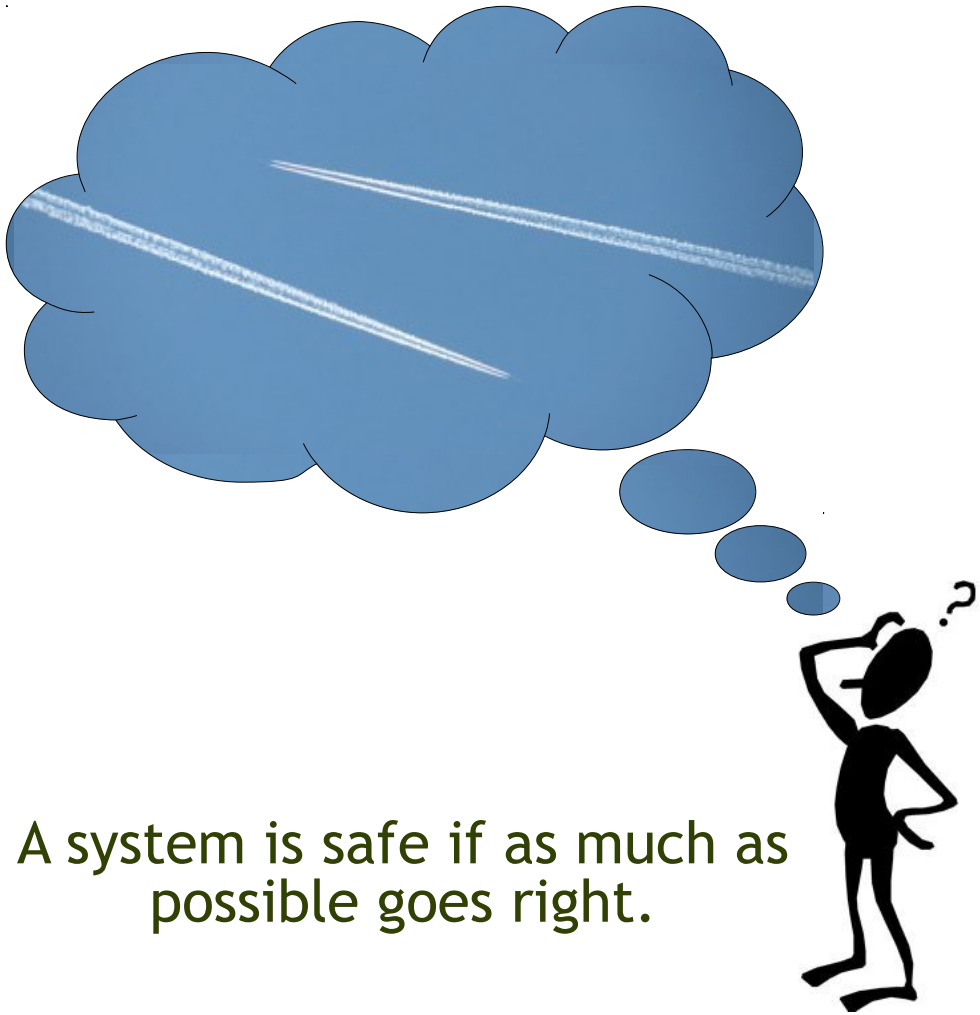
If the level of safety increases, the proxy measure should also increase.

The premise for Safety-II is the need to understand everyday performance.

Safety can only be improved by studying situations where it is present!

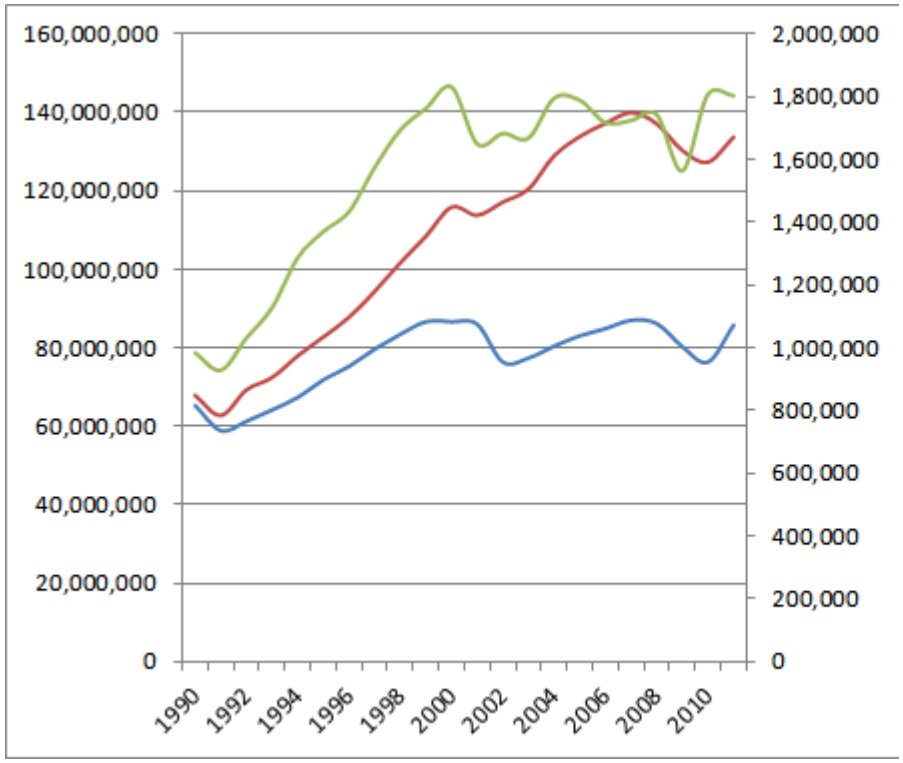
Safety-II is achieved by trying to make sure that things go right, rather than by preventing them from going wrong.

Thinking about safety



A system is safe if as much as possible goes right.

We should think about safety in terms of how many things go well and how frequently we succeed.



What should we care about?

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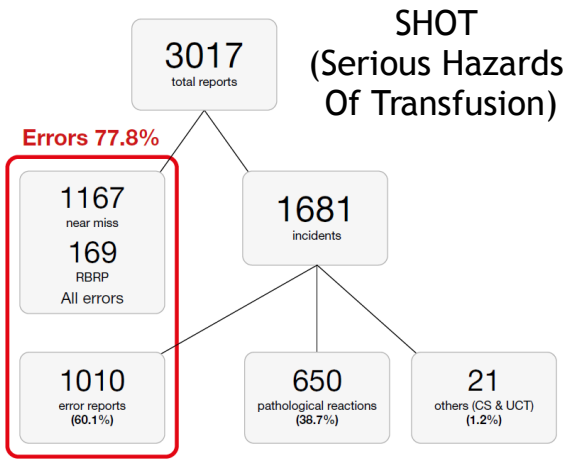
Care about what happens all the time rather than about what happens rarely.

The numerator is how many there are of a type of event – accidents, incidents, etc. This number is known (with some uncertainty)



Numerator

Denominator

The denominator is how many cases something went well. This number is usually unknown.

We always count the number of times something goes wrong. We analyse the rare events.

We rarely count the number of times something goes well. We need to understand the common events.

What should we be looking for?

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Look for 'work-as-done' - the habitual adjustments and why they are made

In order to understand WHY this happened ...

How do people create and maintain good working conditions?

How do people compensate for what is missing?

How do people avoid future problems?

... we must understand HOW this happens!

When we notice something that has gone wrong ...

→

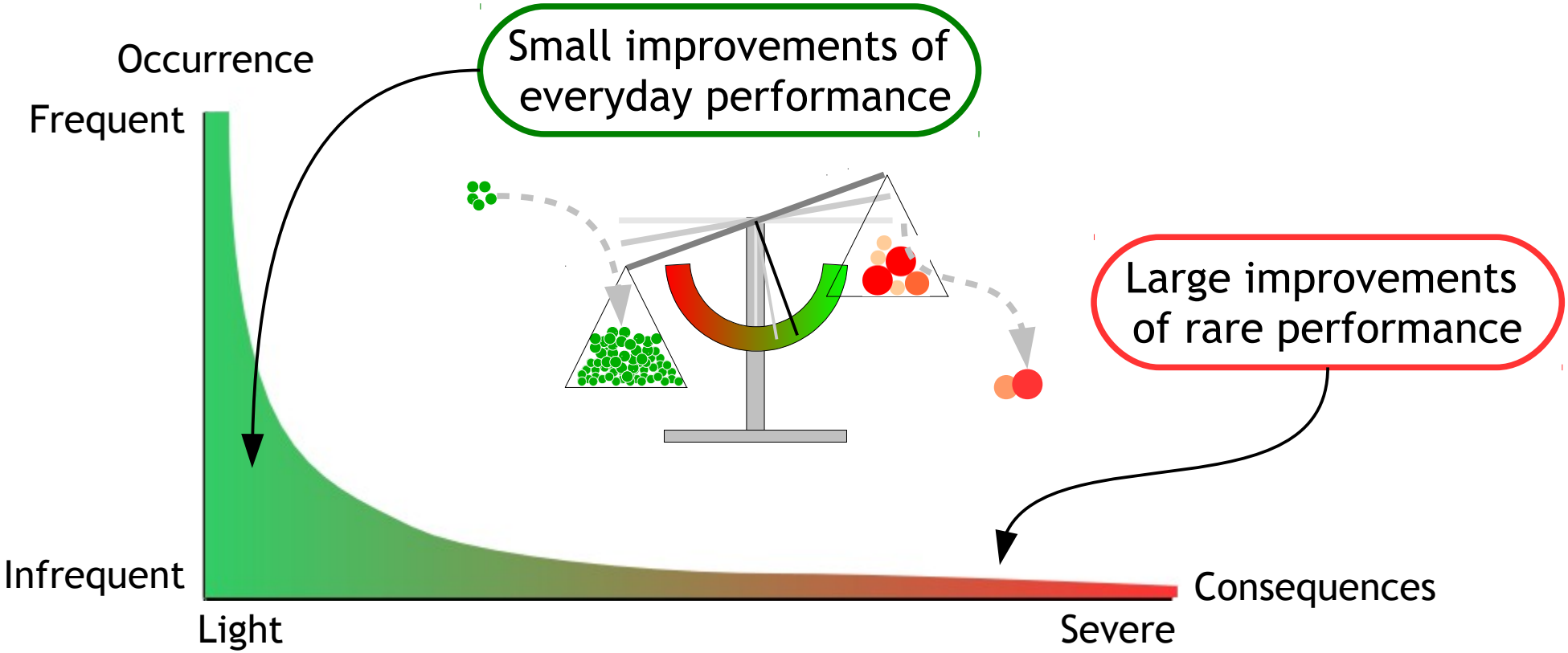
... it is a safe bet that it has gone right many times before ...

→

... and that it will go right many times in the future.

What should we learn from?

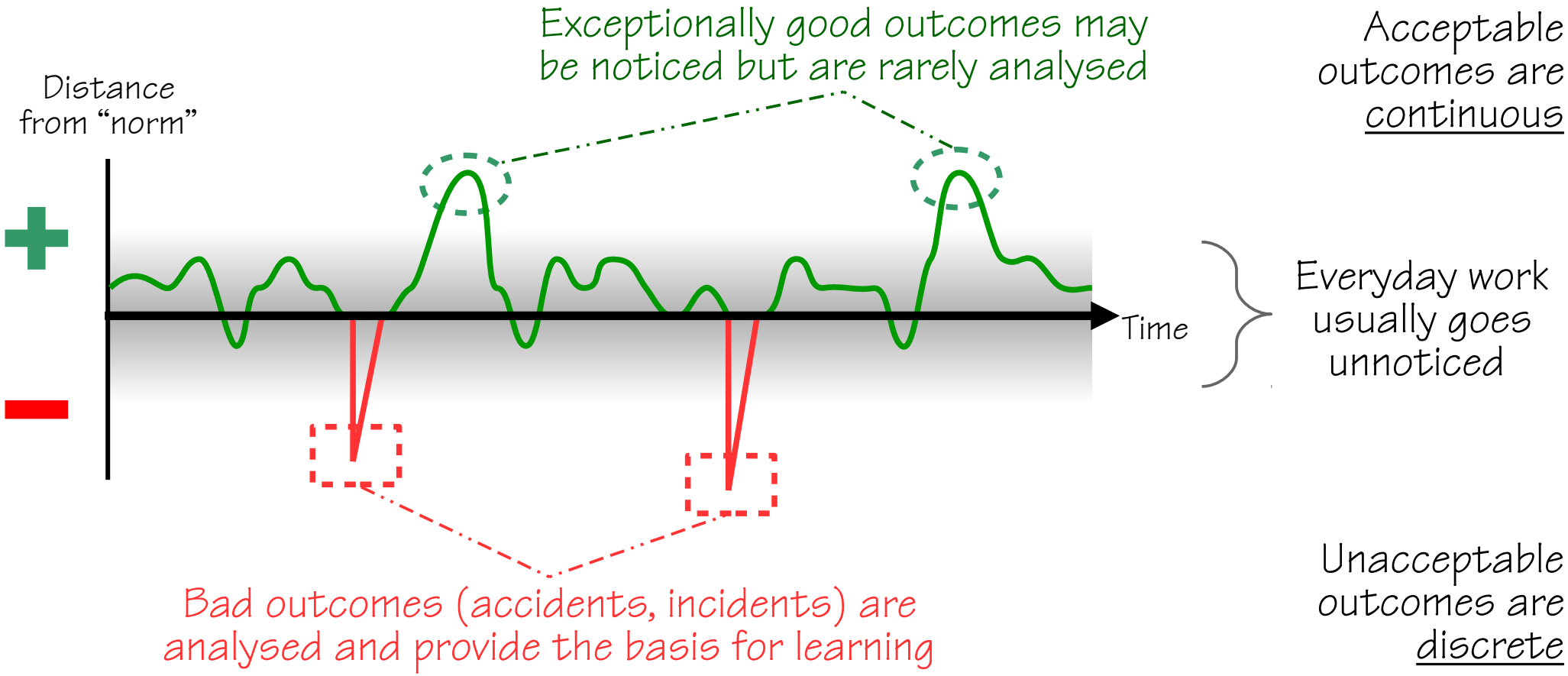
Learn from what is frequent/regular, not from what is infrequent/irregular.



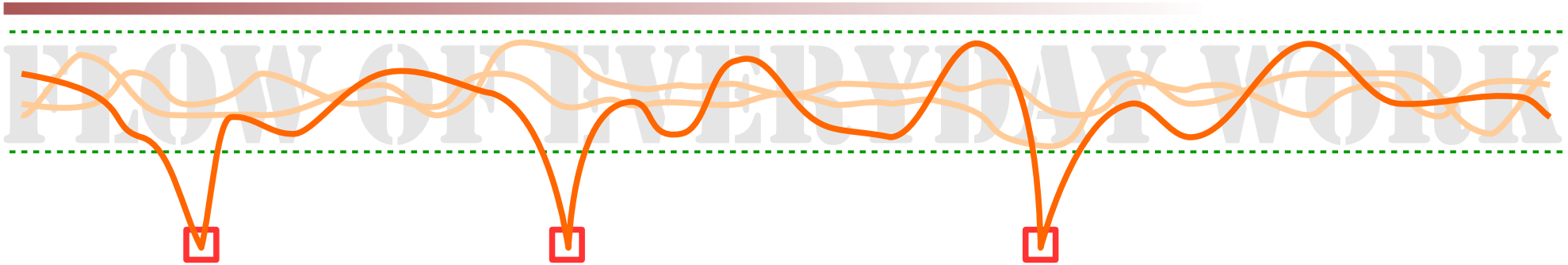
The effects are easier to measure, and can be seen in both safety and productivity.

The analysis of failures

Improvements to safety are based on analysing situations where something went wrong, hence on a set of snapshots of a system that has failed, described in terms of individual "parts" or system structures.



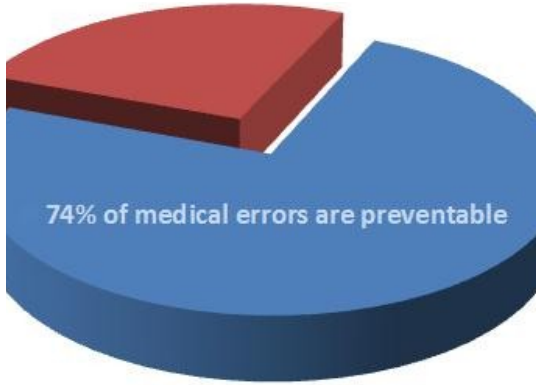
Goal: Reduction of harm and waste



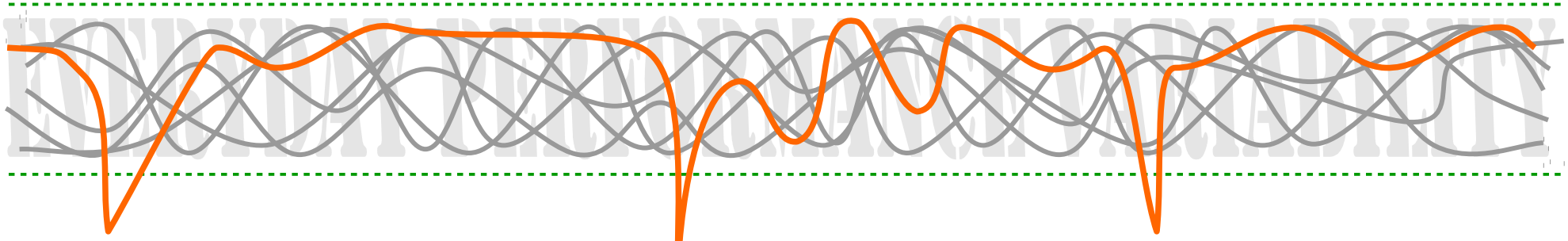
Harmful events attract attention. But they are rare and isolated.

Events are analysed step-by-step and part-by-part.
Prevention/responses are developed for each problem found.

System integration, if any, refers to system structures rather than to system functions.



Conclusions



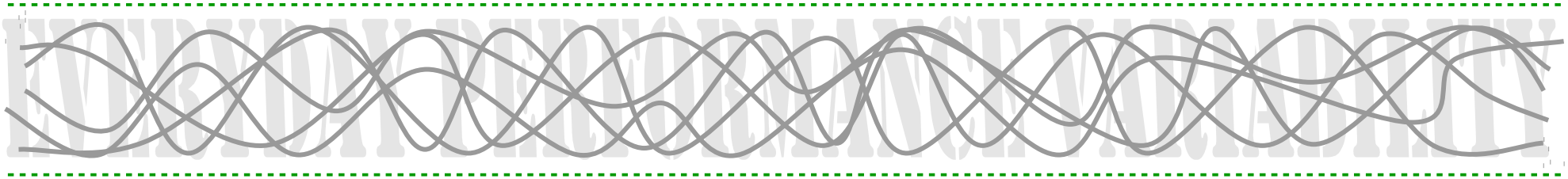
Safety cannot be based on analyses of accidents and incidents alone. These represent single instances or snapshots of failures.

Lessons from accident analyses are (logically) only valid if exactly the same conditions occur again.

Safety-I:
Safety through analysis

Prevent, eliminate, constrain. Safety, quality, etc. are different and require different measures and methods.

Conclusions



The alternative is to learn from what goes well - everyday performance variability.

Performance is a continuous flow. Improvements can be based on frequent patterns rather than single instances.

Support, augment, facilitate. Safety, quality, etc. are inseparable and need matching measures and methods.

Safety-II:
Safety through synthesis

Miyamoto Musashi (c. 1584-1645)

五輪書 The Book of Five Rings

Do not think dishonestly.
The Way is in training.
Become acquainted with every art.
Know the Ways of all professions.
Distinguish between gain and loss in worldly matters.
Develop intuitive judgement and understanding for everything.
Perceive those things which cannot be seen.
Pay attention even to trifles.
Do nothing which is of no use.


Thank you for your attention