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.

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Act/Association</th>
<th>Description</th>
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<tbody>
<tr>
<td>1802</td>
<td>Coal Mines Act</td>
<td>Act for the preservation of the Health and Morals of Apprentices and others employed in Cotton and other Mills, and Cotton and other Factories</td>
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<td>1833</td>
<td>HM Factory Inspectorate Act</td>
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<tr>
<td>1872</td>
<td>Mines Act</td>
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<tr>
<td>1875</td>
<td>Explosives Act</td>
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<td>1878</td>
<td>Threshing Machines Act</td>
<td></td>
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<tr>
<td>1923</td>
<td>National “Safety First” Association</td>
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<td>1941</td>
<td>Royal Society for the Prevention of Accidents</td>
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<tr>
<td>1975</td>
<td>Health and Safety Executive (HSE)</td>
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<td>1950s</td>
<td>USAF System Safety Engineering</td>
<td></td>
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<tr>
<td>2006</td>
<td>ICAO Safety Management System Standard</td>
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We need to **be** safe and to **feel** safe

Accidents, incidents, breakdowns, disruptions.

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

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.

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)

What happens when there is no measurable change?
Different process → different outcome

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

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.

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

If we want something to increase, why do we use a proxy measure that decreases?
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
What should we be looking for?

10^{-4} := 1 failure in 10,000 events

Adverse outcomes = Absence of safety

‘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”

Design (tools, roles, environment)  Work & production planning (“lean” - optimisation)  Safety management, investigations & auditing

Work-As-Imagined  Work-As-Imagined  Work-As-Imagined

Work-As-Done

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And now over to Maria ...
Blood transfusion: WAI ≠ WAD
Wrong Blood in Tube (WBIT)

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

(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.

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

www.vmia.vic.gov.au
My god, it’s full of stars ...
... but most of it is Dark Matter

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”.

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Same process → different outcomes

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

Everyday work (performance variability) → Failure (accidents, incidents) → Unacceptable outcomes

Malfunction, non-compliance, error
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.

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

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

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

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

A system is safe if as much as possible goes right.
What should we care about?

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).

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

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

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

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What should we be looking for?

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?

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

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

When we notice something that has gone wrong …

… we must understand HOW this happens!

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What should we learn from?

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

- Small improvements of everyday performance
- Large improvements of rare performance

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

Everyday work usually goes unnoticed. Exceptionally good outcomes may be noticed but are rarely analysed.

Bad outcomes (accidents, incidents) are analysed and provide the basis for learning.

Acceptable outcomes are continuous. Unacceptable outcomes are discrete.
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.
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

We are safe if there is as little as possible of this

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.

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

We are safe if there is as much as possible of this

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

Safety-II: Safety through synthesis

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Miyamoto Musashi (c. 1584-1645)

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