I want to believe.
Some myths about industrial safety.
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Myths

- Myths refer to fiction, imaginary stories
- They rely on symbols (e.g. heroes)
- Carry common values and beliefs

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Fiction + Symbols + Common values =

Potential for dissemination
Potential for impact on beliefs
Potential for impact on decisions and behaviour
Human error

Myth: Human error is the largest single cause of accidents and incidents
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- Safe systems reliability: $10^4 = 1$ failure for 9999 cases of normal operation
- If humans cause that failure, who causes normal operation?
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- A320 at Mont Sainte Odile (F)
- Crash in Jan 1992, 87 casualties
- Crew selects wrong descent mode
- Time pressure
- No alert from flight systems
- Nighttime
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Human error is a consequence of unfavourable conditions
Myth: Systems will be safe if people comply to procedures
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- Snorre A offshore platform
- Gas blowout from the seabed in Nov 2004
- High risk of explosion
- Procedure says evacuate
- Platform manager + volunteers decide to stay
- Team plugs the leaking well with concrete
Myth: Systems will be safe if people comply to procedures

- DC-10, United Airlines 232
- Crash in Sioux City in July 1989
- Rear engine disintegrates
- Hydraulic loss of all control surfaces
- The 2 pilots improvise with a 3rd pilot from passengers
- 50% of lives onboard are saved

Procedure compliance

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Non compliance to procedures does not mean safety is lost
Protection and safety

Myth: More protection results in higher safety
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- Experiment from Aschenbrenner & Biehl (1994)
- Taxi fleet divided in 2: with & without ABS
- Taxis equipped with ABS change their driving behaviour
- Risk homeostasis (Wilde, 1994)

Definitely not a French taxi

Wilde (1994) Target risk.
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People react to an increase of the perceived level of protection

Wilde (1994) Target risk.

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Root cause analysis

Myth: Root cause exists and can be found
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- Events in the future will be a repetition of those of the past
- Things happen in a bimodal way
- Cause-effect relationships can be described exhaustively

A fish-bone analysis
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A FRAM analysis
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A fish-bone analysis

Events in complex socio-technical systems result from unexpected combinations of non-bimodal factors
Myth: Accident investigation is rational
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- Time (and public) pressure when analysing large critical events
- Depth analysis is often determined by available resources
- Range of known methods is extremely small
- Looks for liabilities as opposed to causes
- WYLFIWYF (Lundberg et al., 2009)
Accident investigation

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Dec 2007: crash of a Rafale fighter in France

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Accident analysis is a social process where causes are constructed

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- Capsized in March 1987; 193 casualties
- Time pressure and competition
- Company operated close to the limits of safety envelope

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Safety will only be as high as affordable; it is trade-off.
So what?
Humans are reliable

Operators are the last barrier before mishaps

Operators gather experience and knowledge

Innate recovery skills

Humans try to understand problems
From an operator's point of view...

Humans are reliable

- Humans try to understand problems
- Operators gather experience and knowledge
- Innate recovery skills
- Conditions do not always allow recovery
- System is too complex
- Performance shaping factors

- Operators are the last barrier before mishaps
- Humans have limited capacities
- Less than perfect design

What you want to strengthen

From an operator's point of view...
From an operator's point of view...

- Humans are reliable
- ...and fallible
From an operator's point of view...

Humans are reliable
...and fallible

Same mental processes but different performance conditions
From an operator's point of view...

Humans are reliable
...and fallible

Same mental processes but different performance conditions

Reliable human operations
Control the effect of conditions on human performance
From an organisational point of view...

Classical safety

...or is it?

- We are preoccupied with failures and do not analyse normal work
- We think avoiding unsafety is equal to safety
From an organisational point of view...

- Classical safety
  - We are preoccupied with failures and do not analyse normal work
  - We think avoiding unsafety is equal to safety

- Resilience engineering
  - Enable system's capacities to respond, monitor, anticipate, learn
  - Safety is what a company does, not something it just has
Thank you