

The future of Just Culture with AI Investigation Tools: do we need to learn trust again?

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COMPUTER SAYS NO
cough

At the root of human contributions to occurrences...



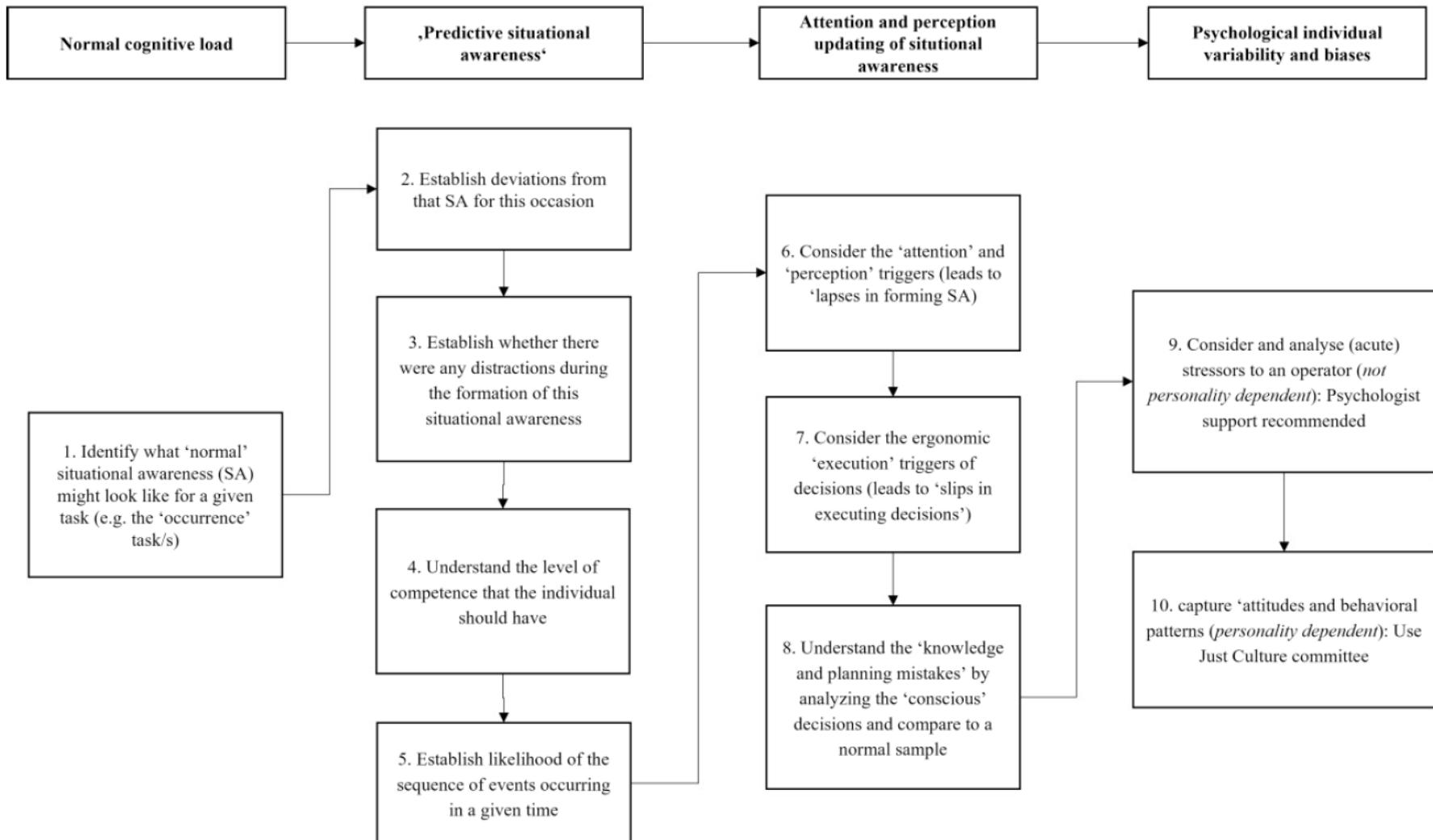
Did you know you had made an error or mistake?

‘No’ is generally the answer in up to 80% of occurrences but when yes...

Did you intend for the outcome?

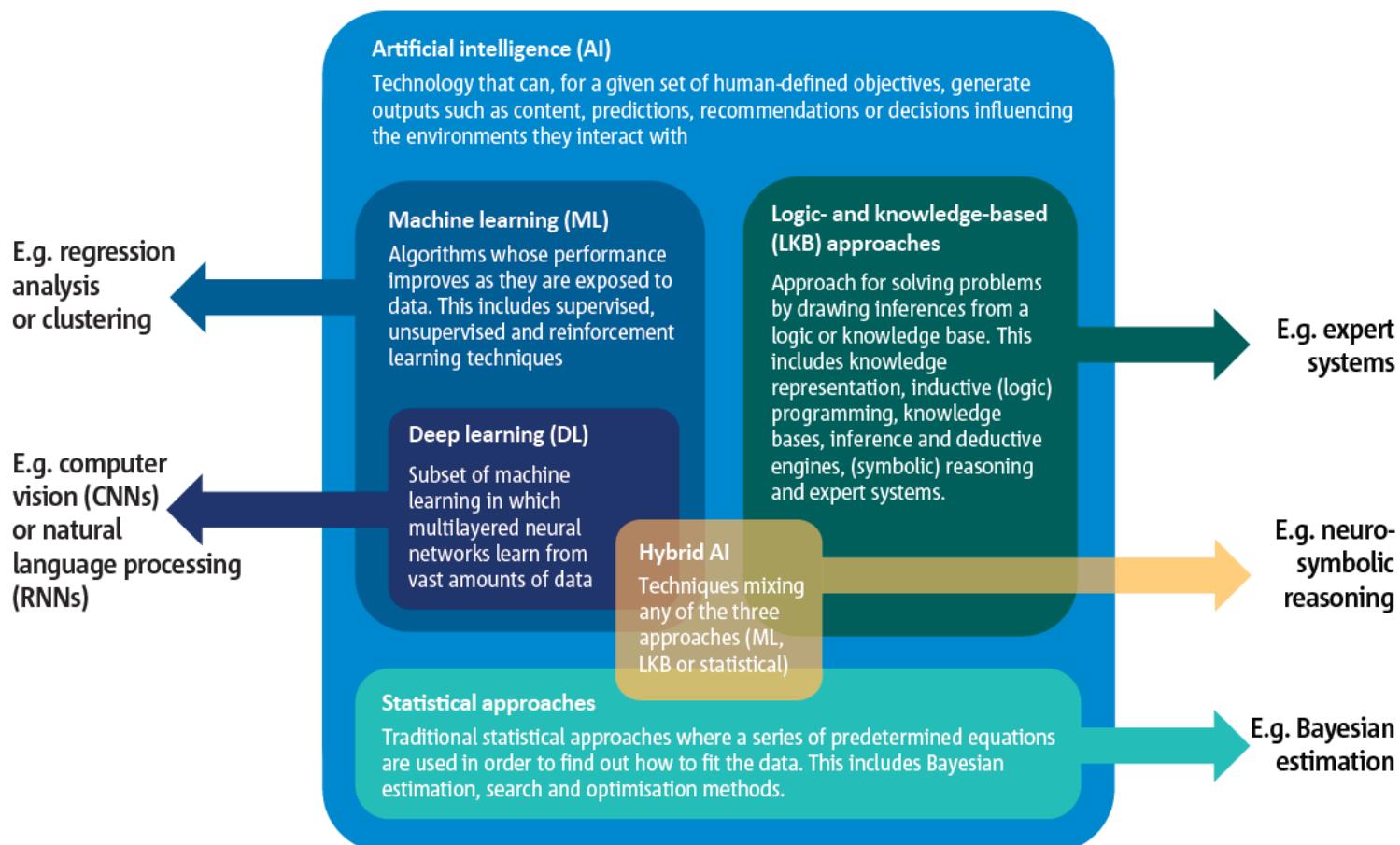
‘No’ the answer for almost all other occurrences

MAHCO is a framework that you can fill with data



What is AI?

EASA Artificial Intelligence Roadmap 2.0 (May 2023)



What is big-data in Aviation?

Ziakkas, D., & Vink, L.S. (Eds) (2023). *The Implementation Guide to Artificial Intelligence in Aviation Transportation*. Purdue University Press.

Global data sets

Top-down data sets:

- Millions of annual flights a year
- Data taken from transmitting data such as Automatic Dependent Surveillance-Broadcast (ADS-B)
- ADS-B analysis such as Aireon or Databeacon (Global companies with access beyond borders)
- Able to be run via HTML based web-apps outside of the local systems
- Provides data that is not calibrated by human-operator decisions



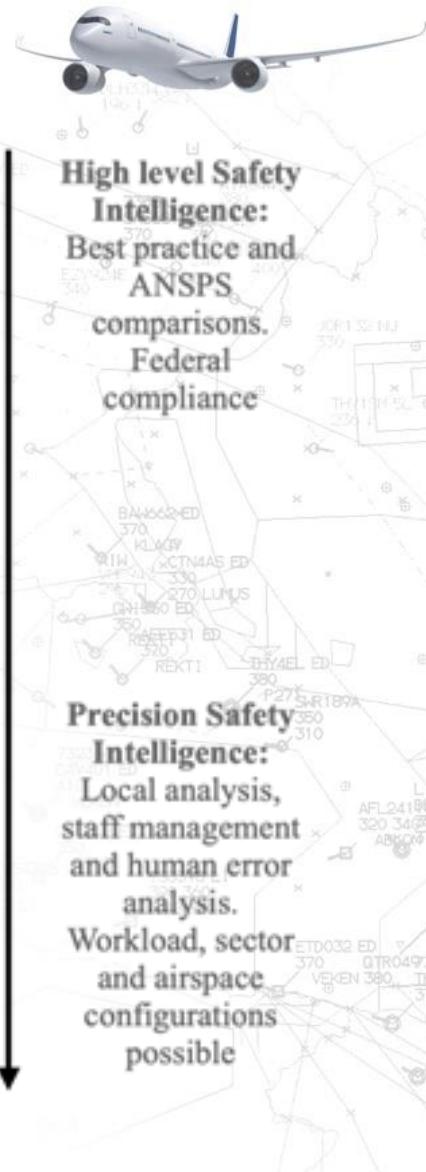
Local data sets

Bottom-up data sets:

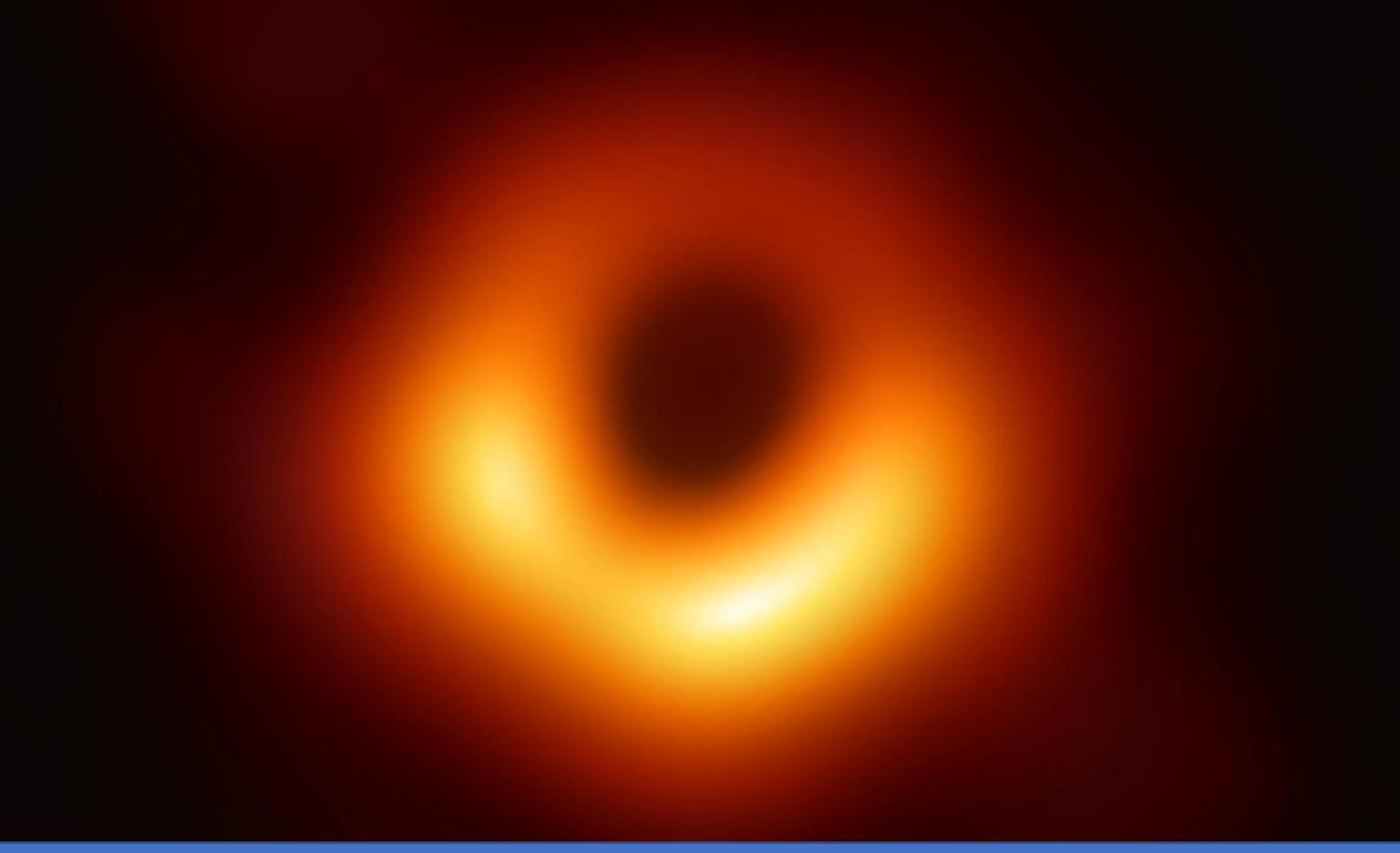
- Local flight data
- Human Performance decisions informed by Complexity, Workload, Fatigue and Rostering data
- Calibrates the overall top-down data
- Data provided from individual ANSPs or States
- Must be put through local algorithms connected to ANSP in-house systems utilising existing system data
- Able to provide insights into how many staff, what fatigue levels, what kinds of human errors, what kinds of workloads certain ATM patterns create

High level Safety Intelligence:
Best practice and ANSPS comparisons.
Federal compliance

Precision Safety Intelligence:
Local analysis, staff management and human error analysis.
Workload, sector and airspace configurations possible



Whta about Data + AI + Brains?

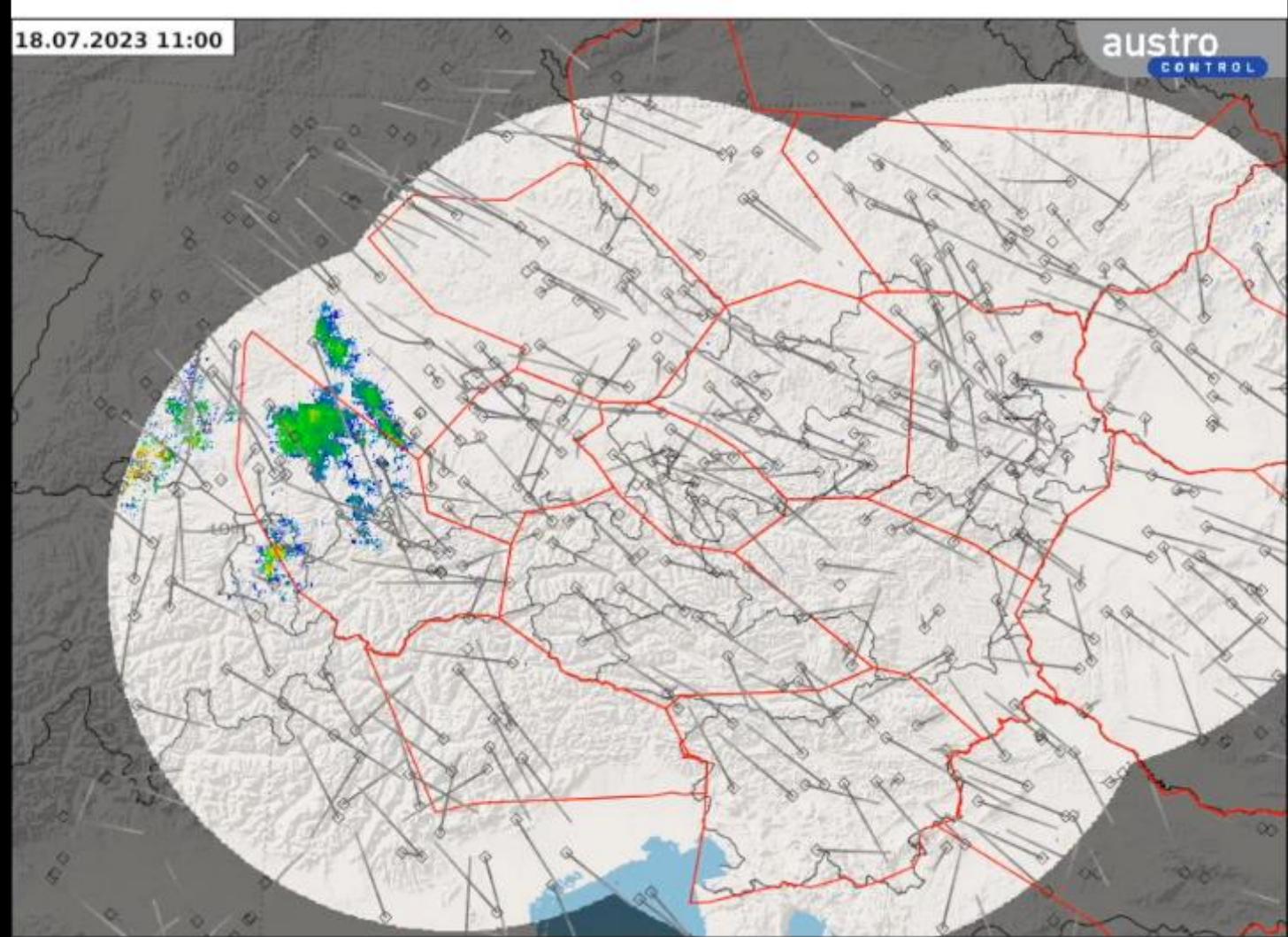


The Blackhole digital image was produced by 8 telescopes capturing data over one week. It was compiled using three different algorithms with less than 1% of the available data. It is an excellent metaphor for three reasons:

1. The brain is like a blackhole. We cannot see it or capture it, but we can capture and measure the light around it
2. The approach to rendering a 'picture' using a small amount of data is applicable in human performance
3. The type of data is not the actual object itself, but rather the behaviour of the surrounding data which 'lights up' the actual object..

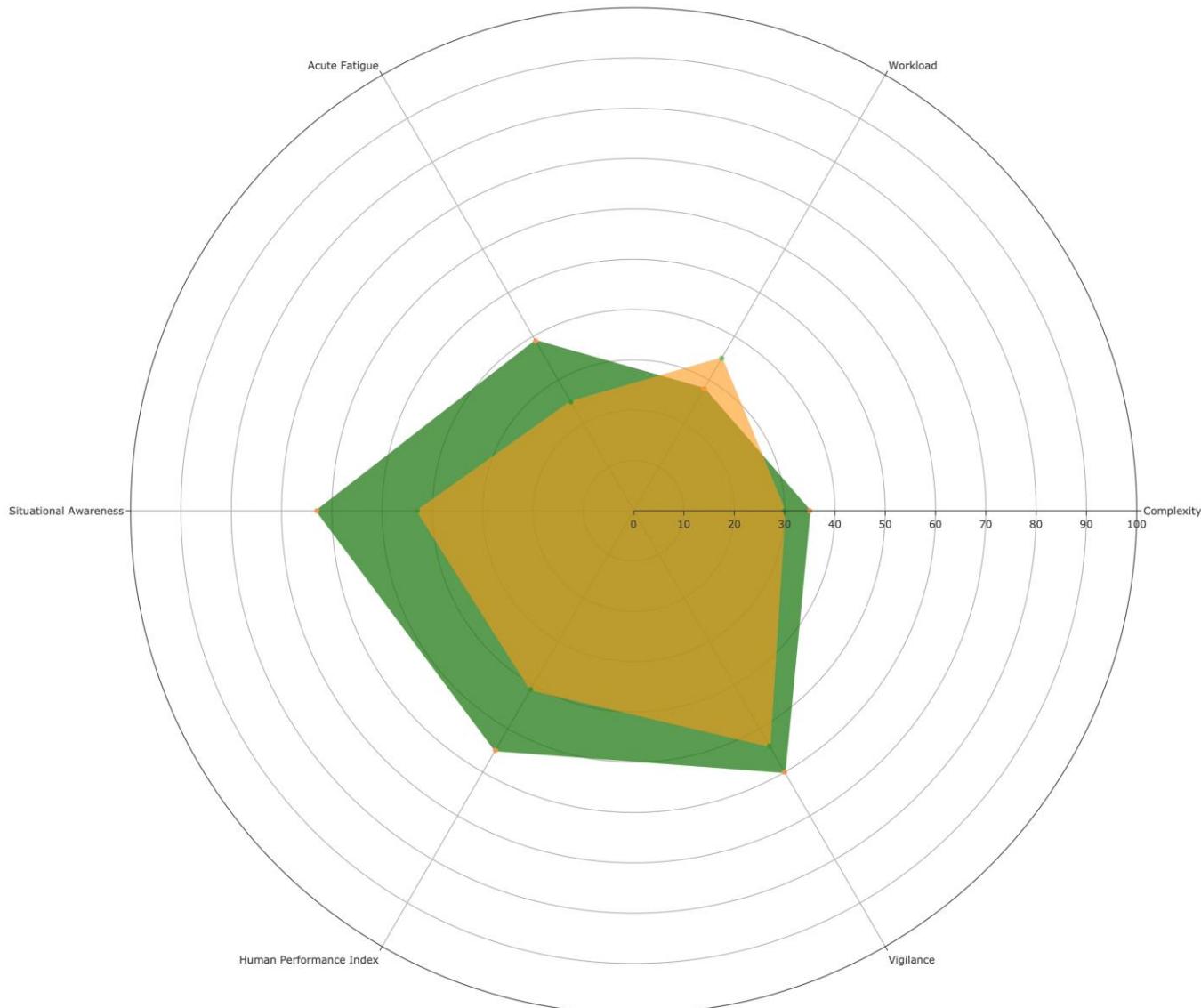
Human performance can be thought of the same way...

Desection of an Overload



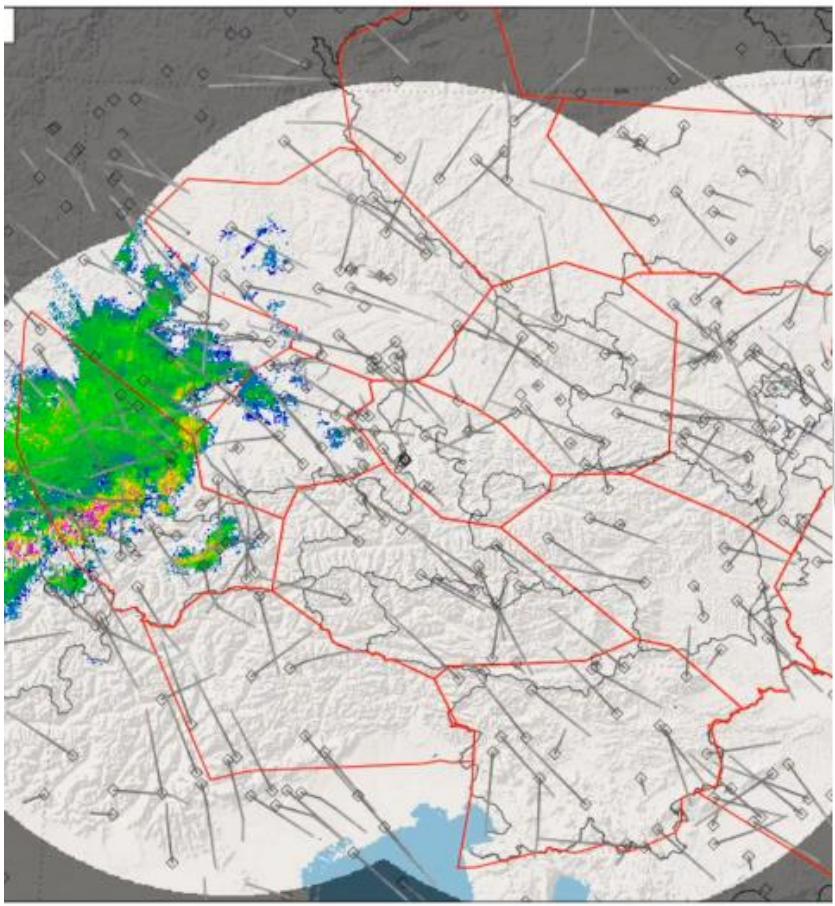
What could a tool show?

austro
CONTROL

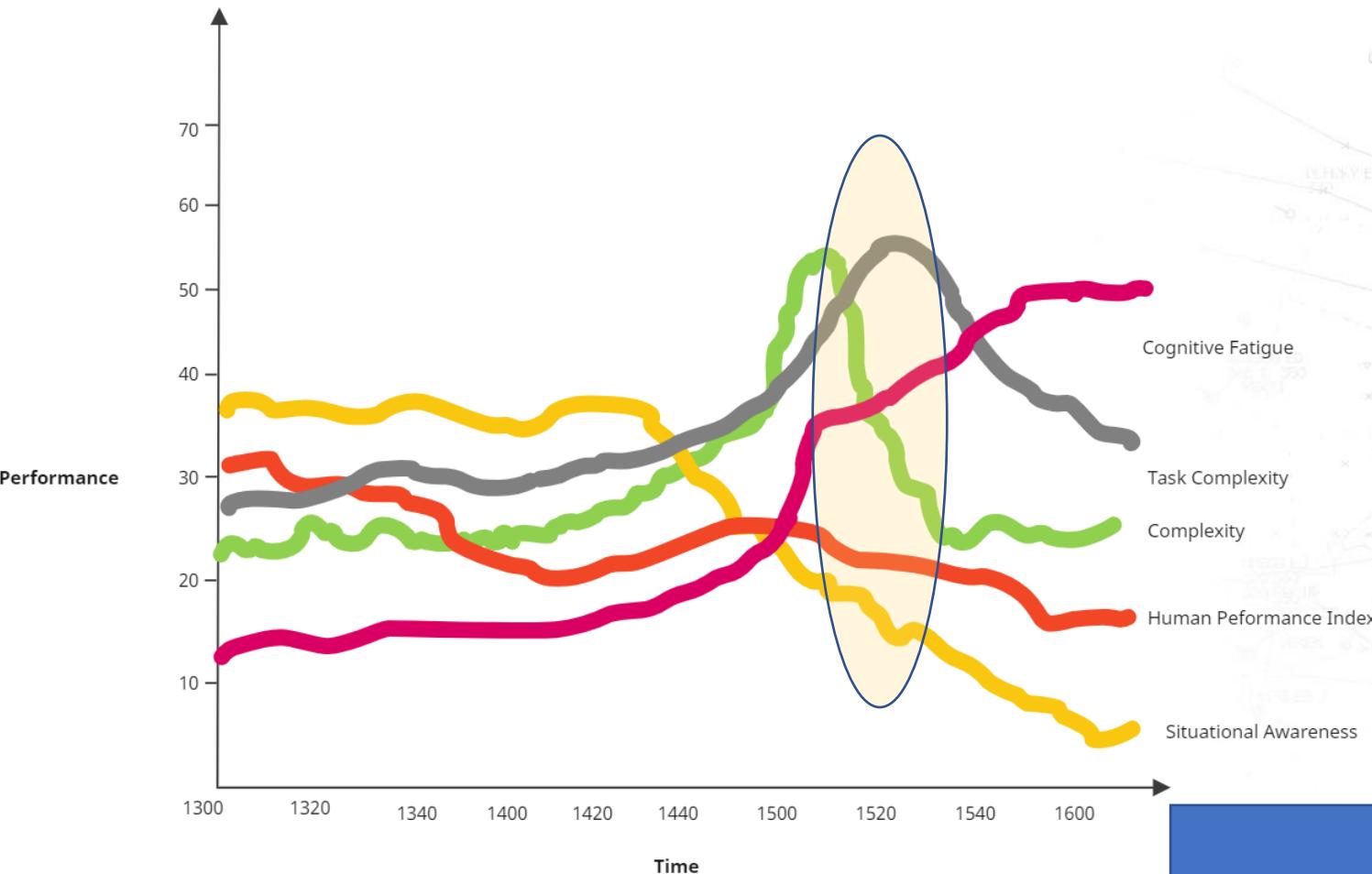


Side by side...

austro
CONTROL



Disection of an overload

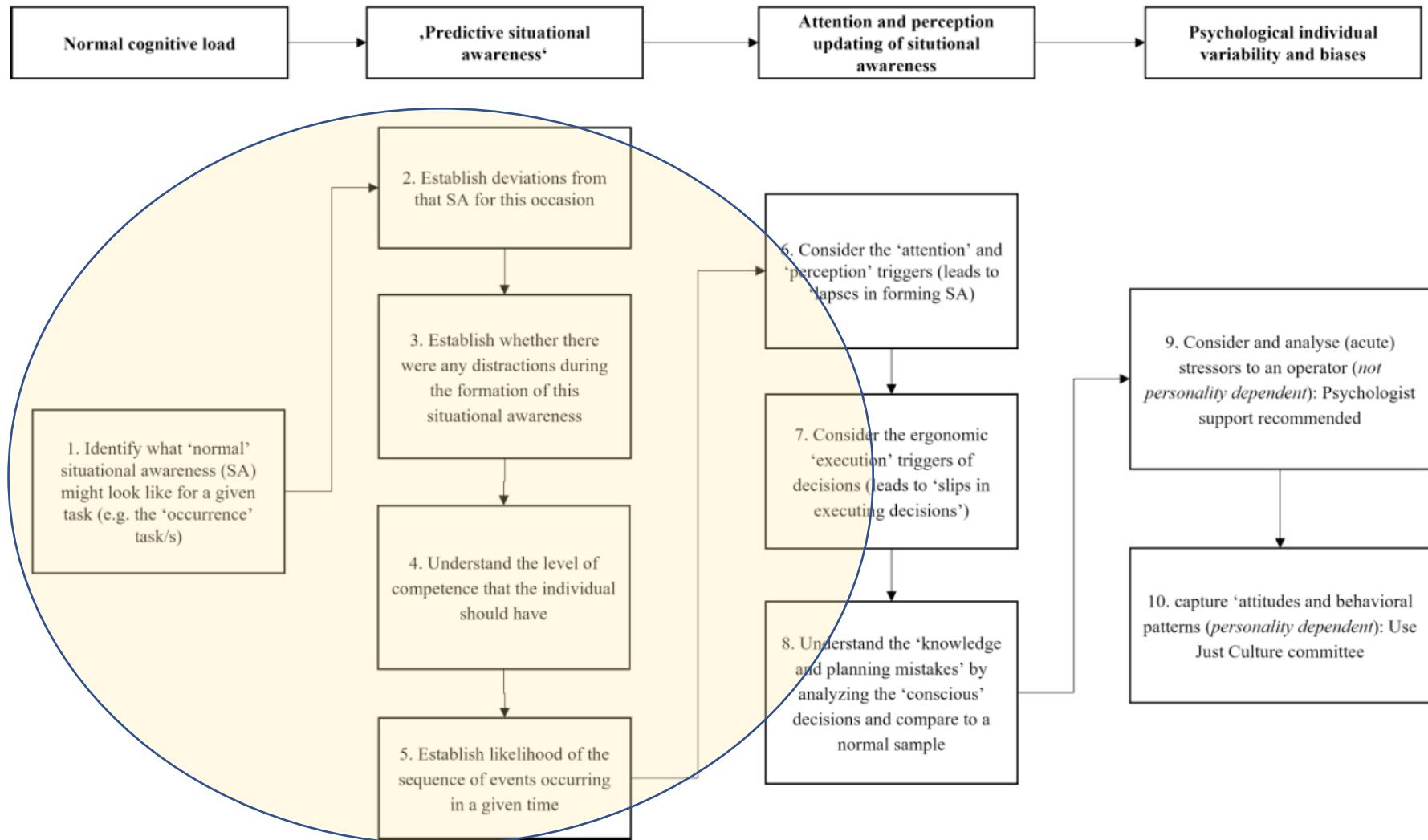


Complexity
proceeds Task
Complexity which
preceeds cognitive
fatigue...

HPI and SA drop

What can we see?

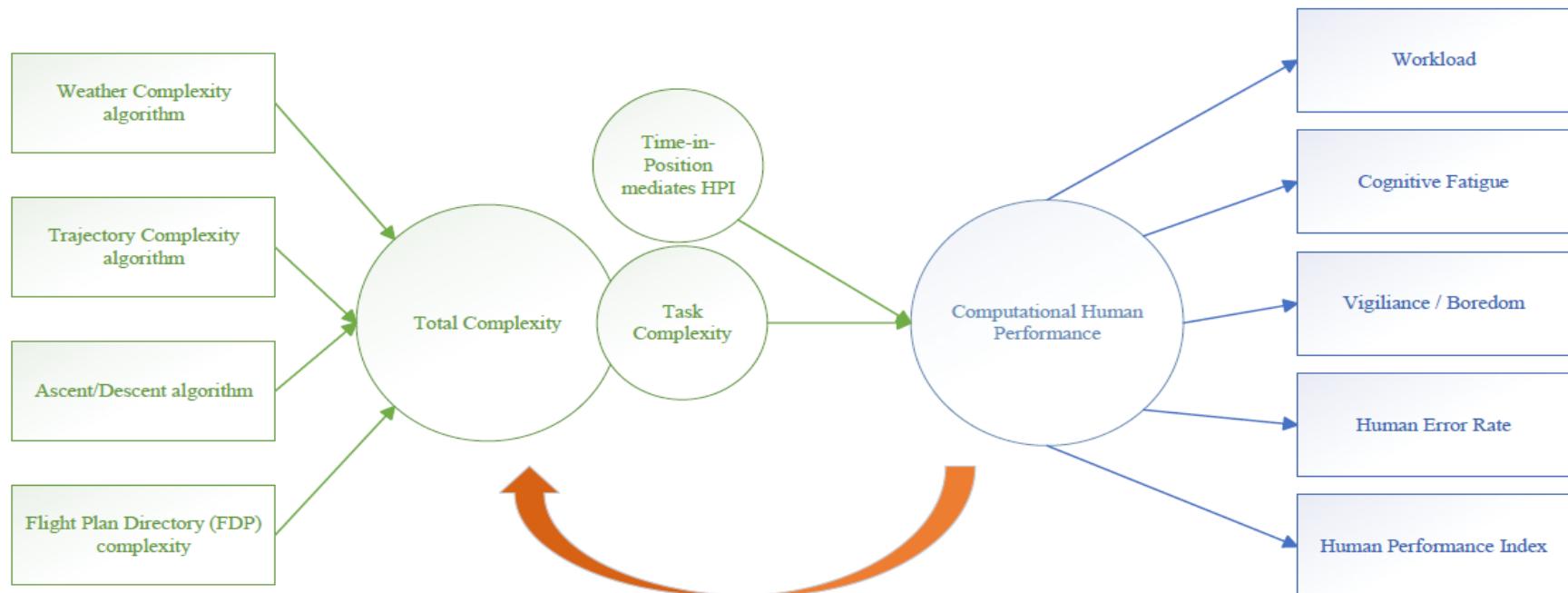
MAHCO is a framework that you can fill with data



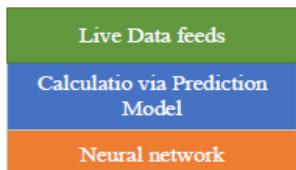
Computational Human Performance in Air Traffic Management

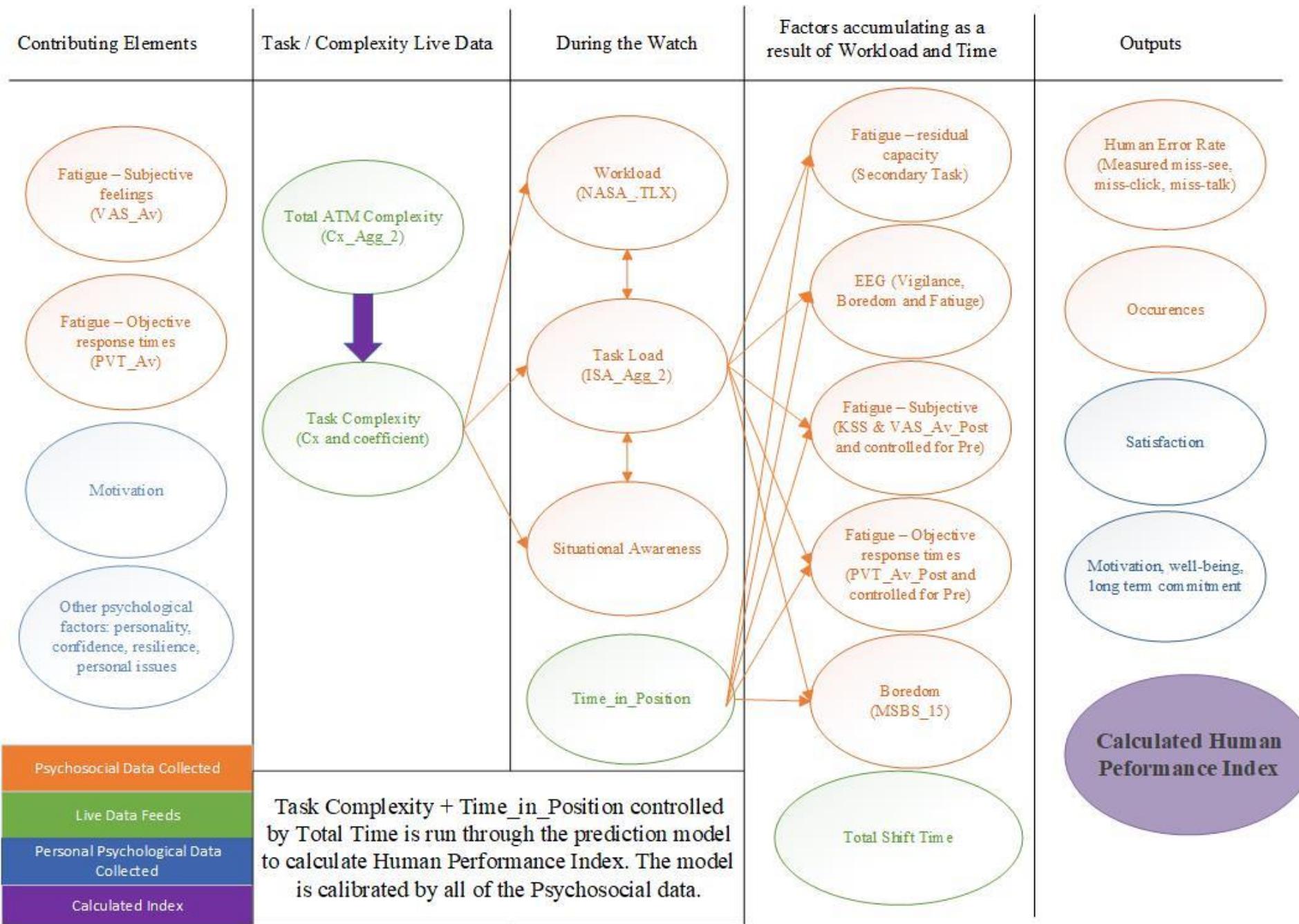
The concept of 'Complexity' is a mathematical algorithm that is fed by source data from various systems. 'Task Complexity' is generated using a validated co-efficient

Human Performance is calculated by feeding 'task complexity' through a prediction model that was validated with psychometric and neuropsychological studies



A Human Performance neural network is then used to teach the system how to use complexity data to predict Human Performance outcomes





What about another example?



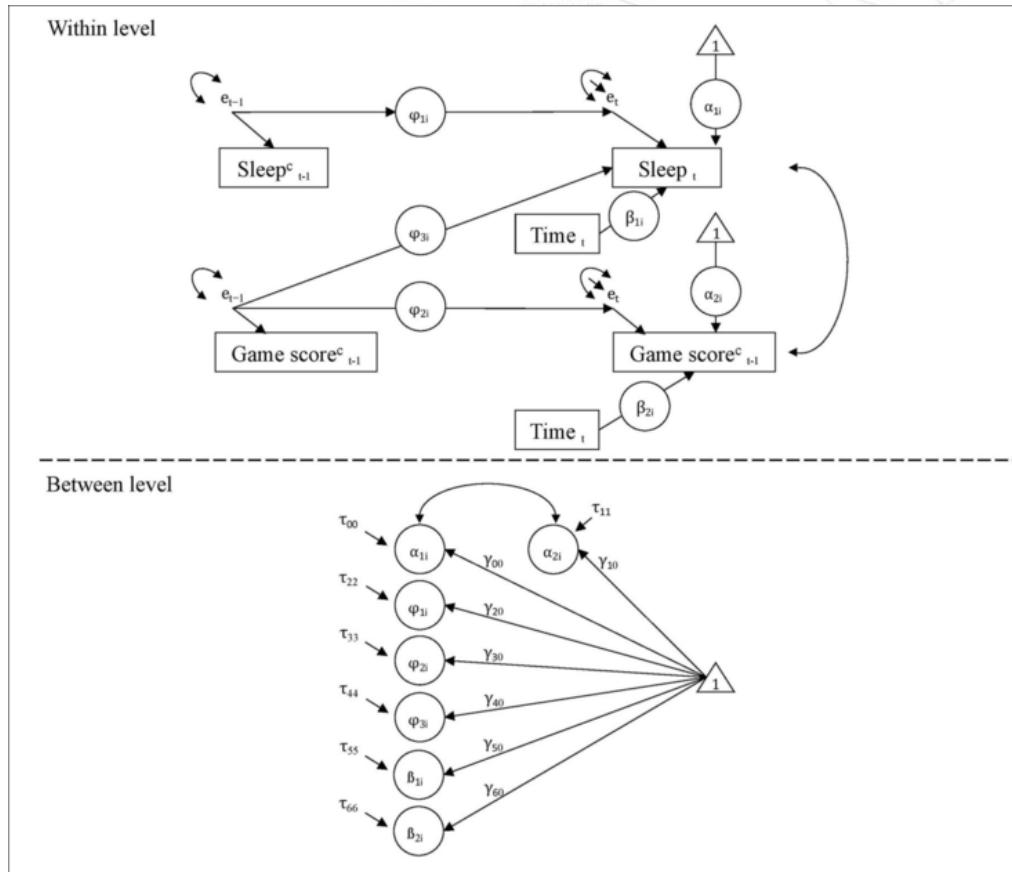
How can 'fatigue' lead to unsafe acts?

Sleep Characteristics in Esport Players and Associations With Game Performance: Residual Dynamic Structural Equation Modeling

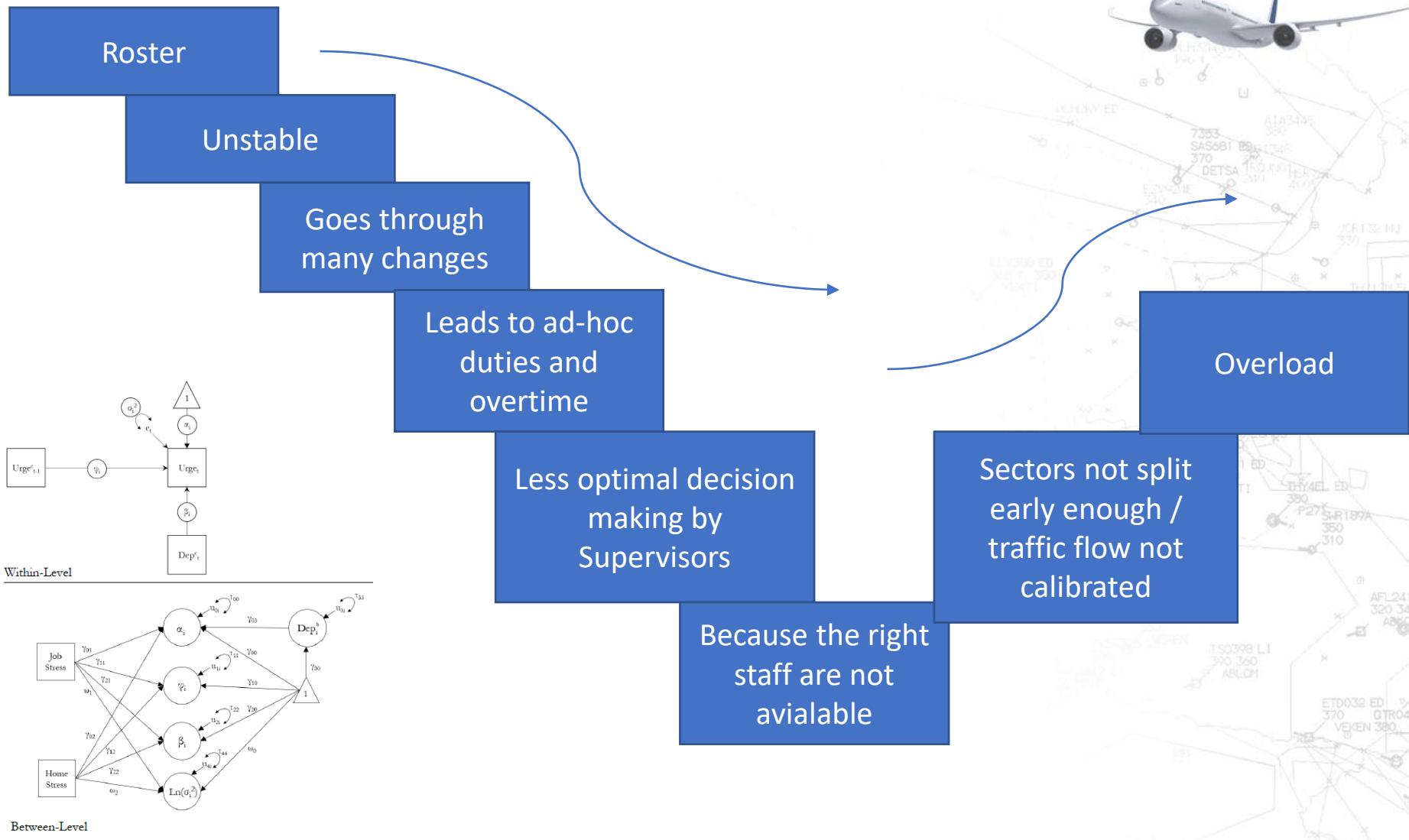
Frode Moen^{1,2*}, *Marte Vatn*³, *Maja Olsen*², *Jan Arvid Haugan*¹ and *Vera Skalicka*⁴

People who perform better, sleep better.

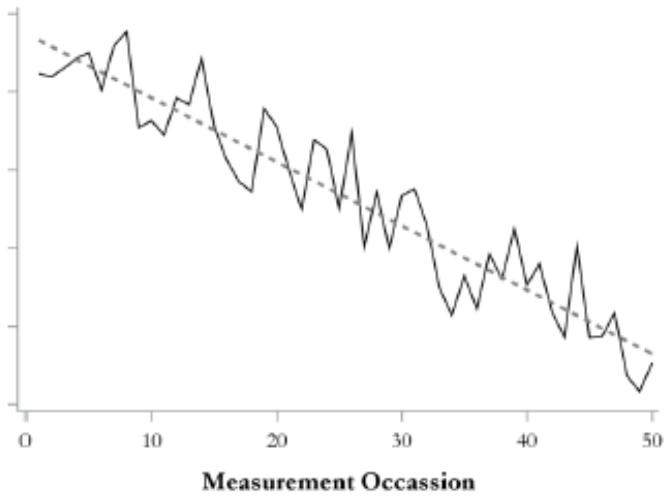
But people who are inconsistent, sleep worse and perform worse



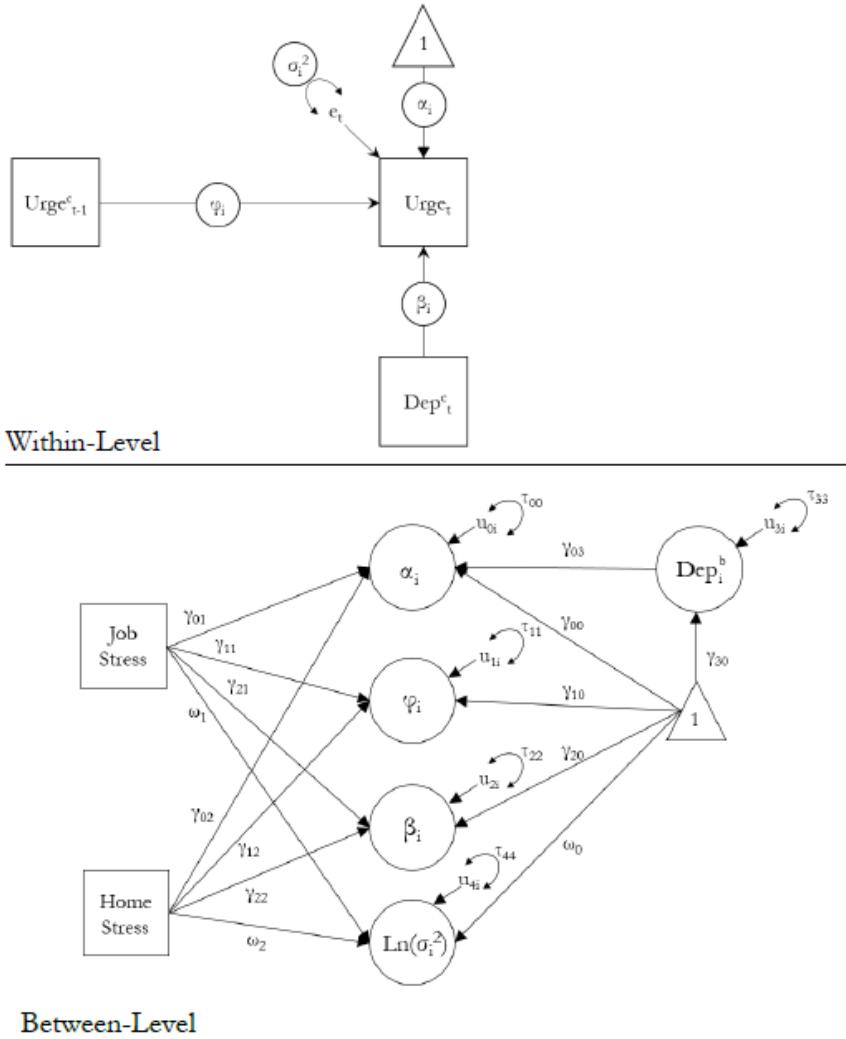
It is not clear, but complex AI analysis and modeling reveals the links in clearer detail



Dynamic Structural Equation Modeling with Rosters – lag time effects

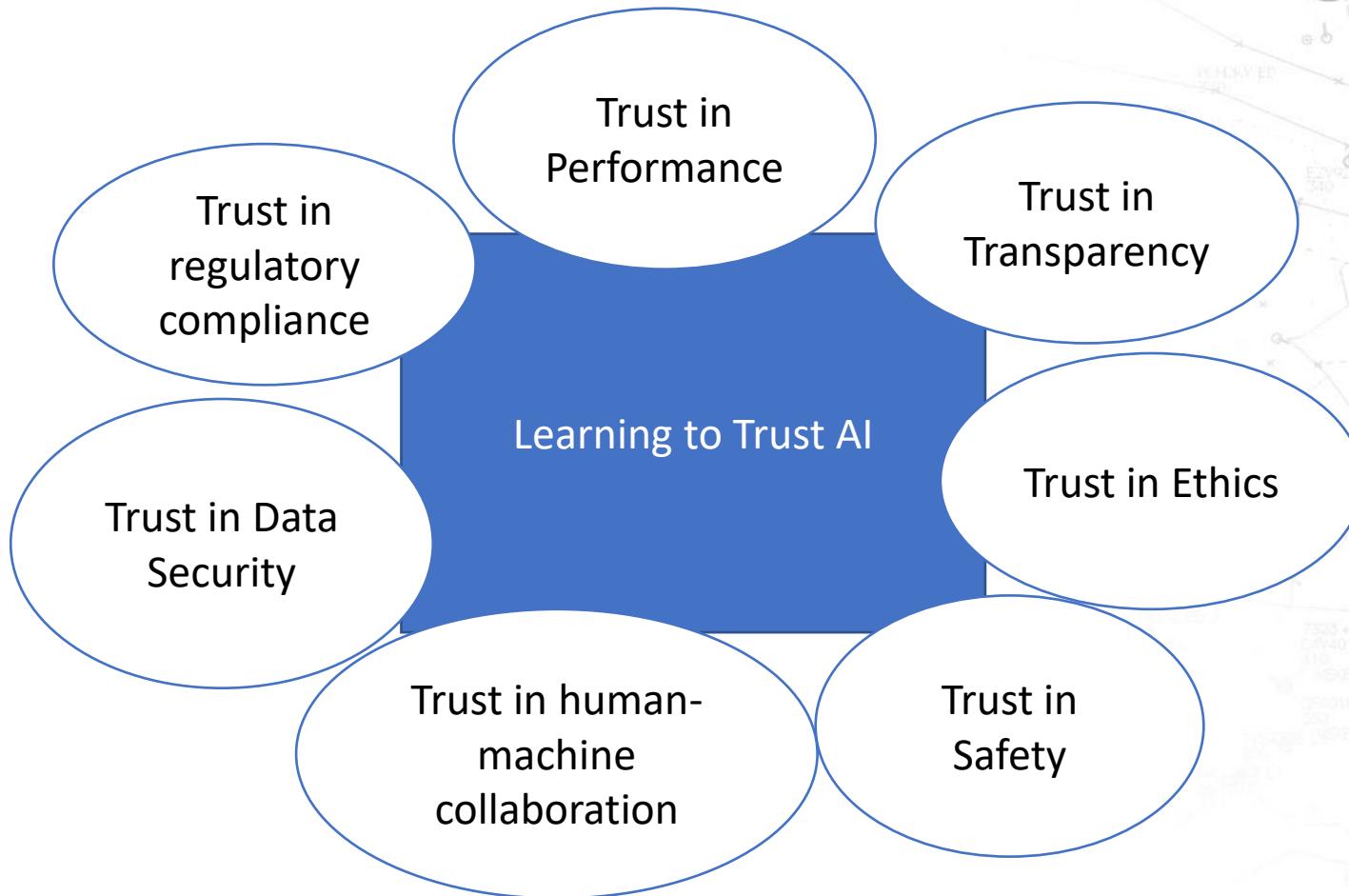


Rostering practices can lead to slow degradation of performance over time...

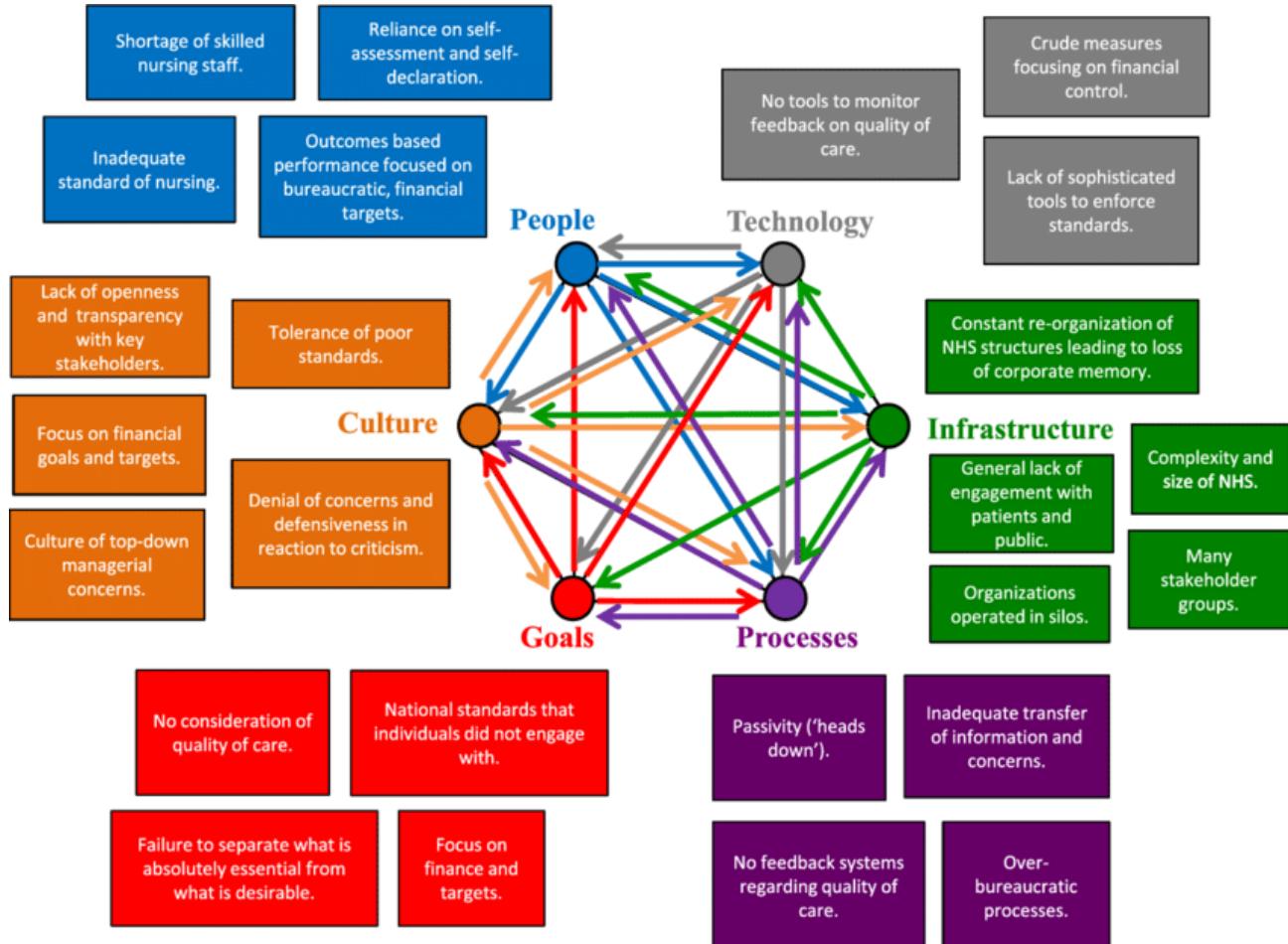


The seven virutes of trust in AI

Ziakkas, D., & Vink, L.S. (Eds) (2023). *The Implementation Guide to Artificial Intelligence in Aviation Transportation*. Purdue University Press.

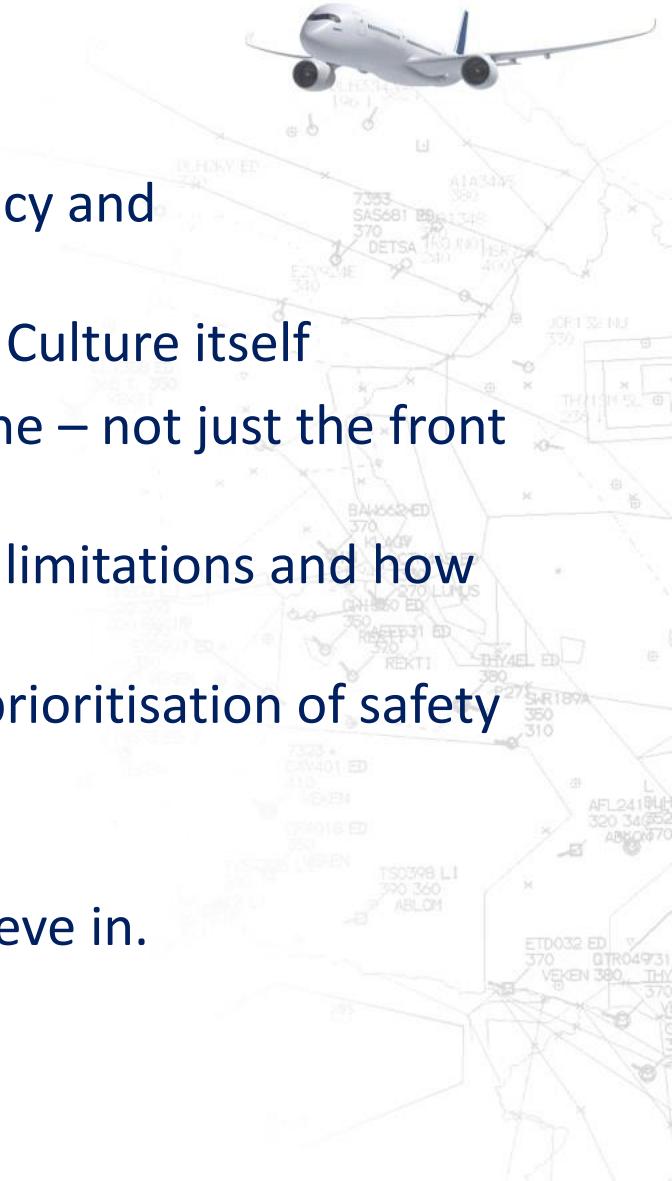


We have to bring people along...



Clegg et al., (2017). Applying organizational psychology as a design science: A method for predicting malfunctions in socio-Technical systems

Blue Print to bring everyone along...



1. Prioritise building trust with operators
2. This requires a commitment to transparency and communication
3. This means sometimes tackling the Safety Culture itself
4. Just Culture policies must apply to everyone – not just the front line
5. We need to communicate the benefits, the limitations and how they work if we want to bring AI tools in
6. Finally, the message must always be: the prioritisation of safety over efficiency

This is what our operators believe in.

Conclusion...

- The adoption of machine learning in aviation is already improving safety and efficiency in the investigation of occurrences and Just culture.
- Ultimately, the success of machine learning in aviation will depend on the ability of operators to build trust with management and to prioritise safety over efficiency.
- By doing so, we can break down the suspicions and the hostility when a tool reveals your potential for improvement or shows situations where honest mistakes have been made.
- We can then look forward to utilising the findings for what they are: opportunities for our own self development, our system development and ultimately our cultural development.

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