SAFEMODE

Strengthening synergies between Aviation and Maritime in the area of Human Factors towards achieving more efficient and resilient MODES of transportation.

University of Strathclyde Glasgow

Training Package

Human Factors and Human Performance.
Key concepts and principles

SAFEMODE-CBHF-M1

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N°814961.

Presentation contents

1. Systems Complexity
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4. Human Factors
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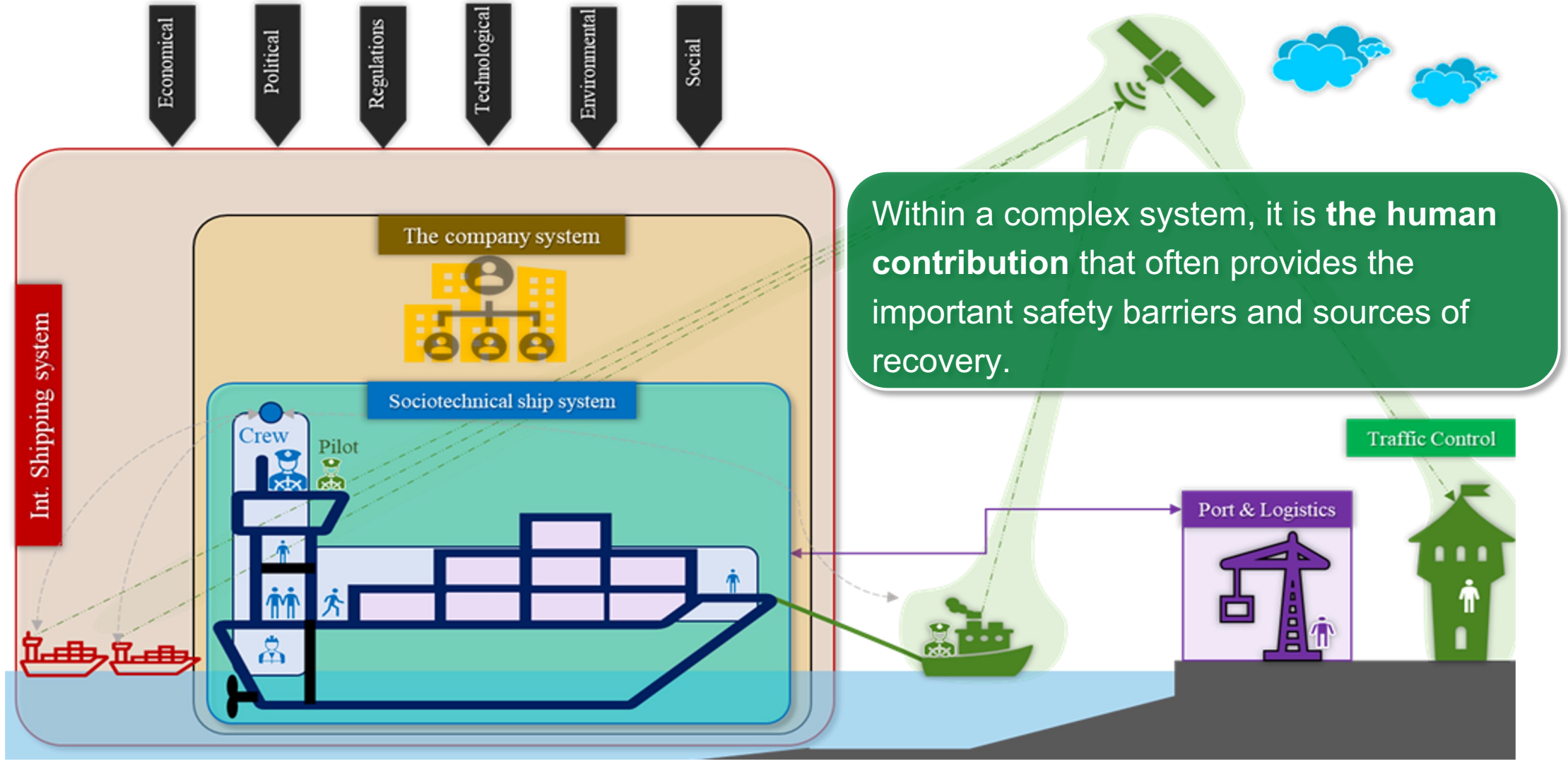
System Complexity-Maritime



Within a complex system, it is **the human contribution** that often provides the important safety barriers and sources of recovery.

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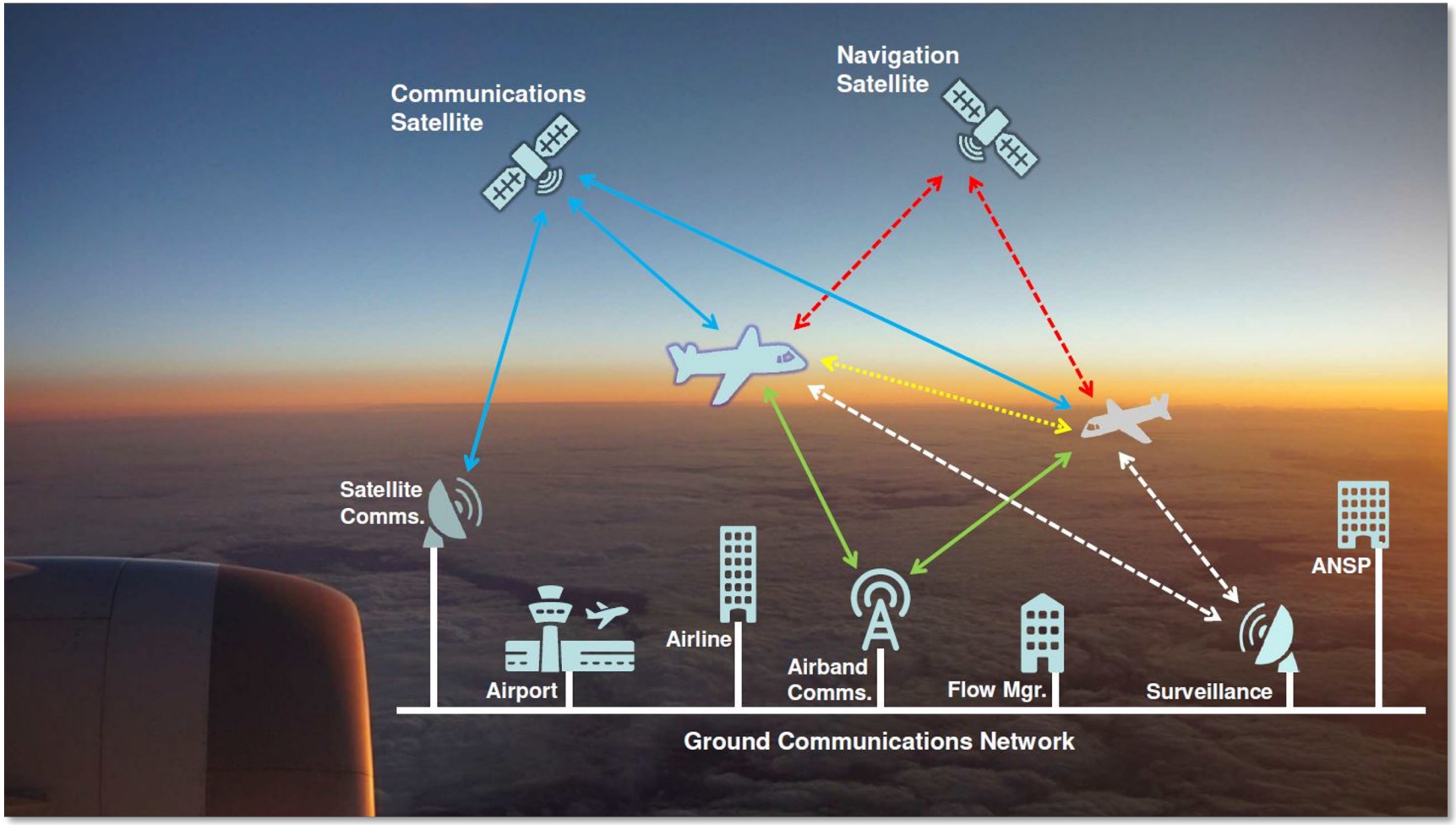
System Complexity-Aviation



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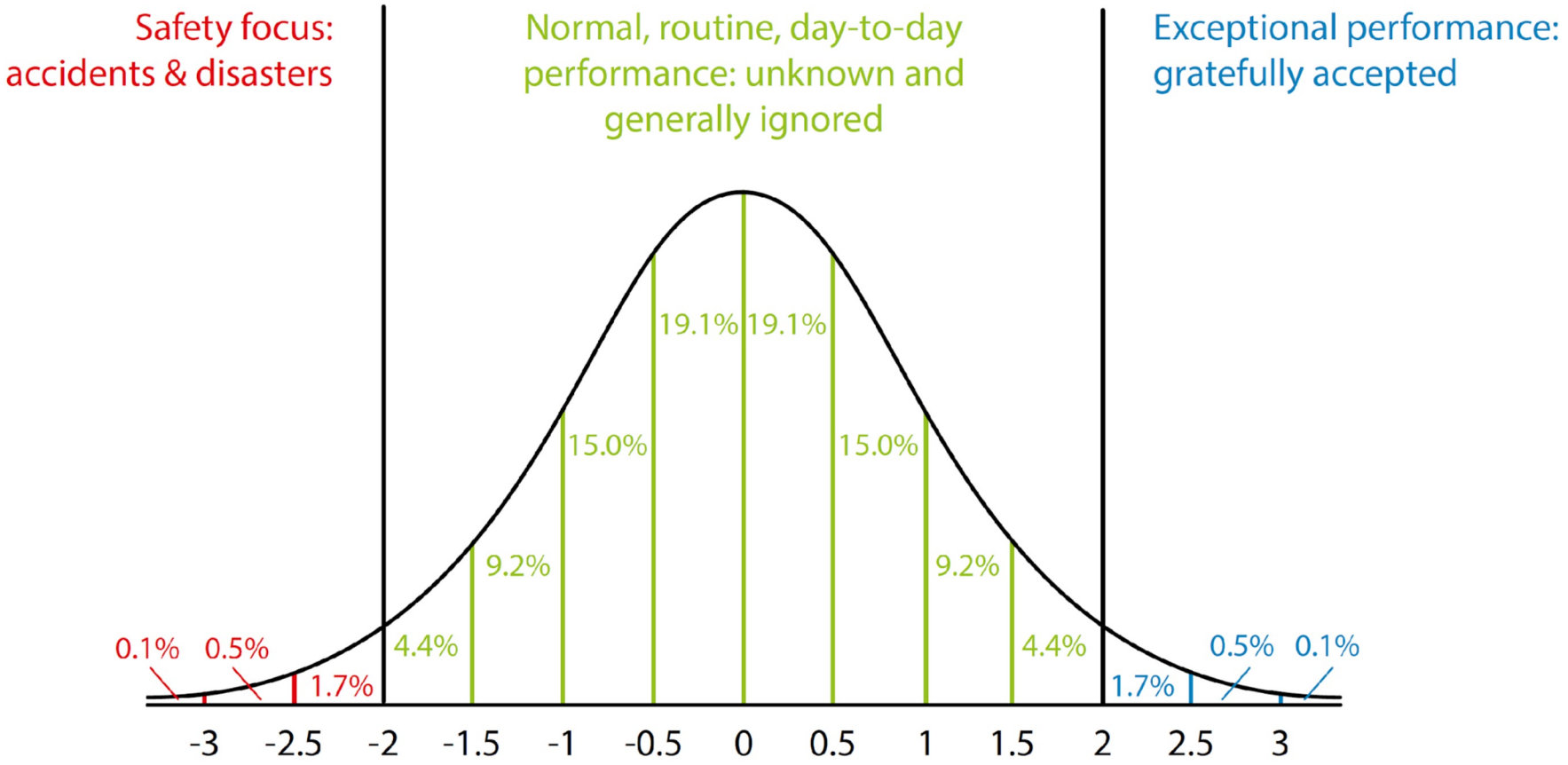
Event Probability & Safety Focus



From Safety-I to Safety-II A White Paper (Eurocontrol)

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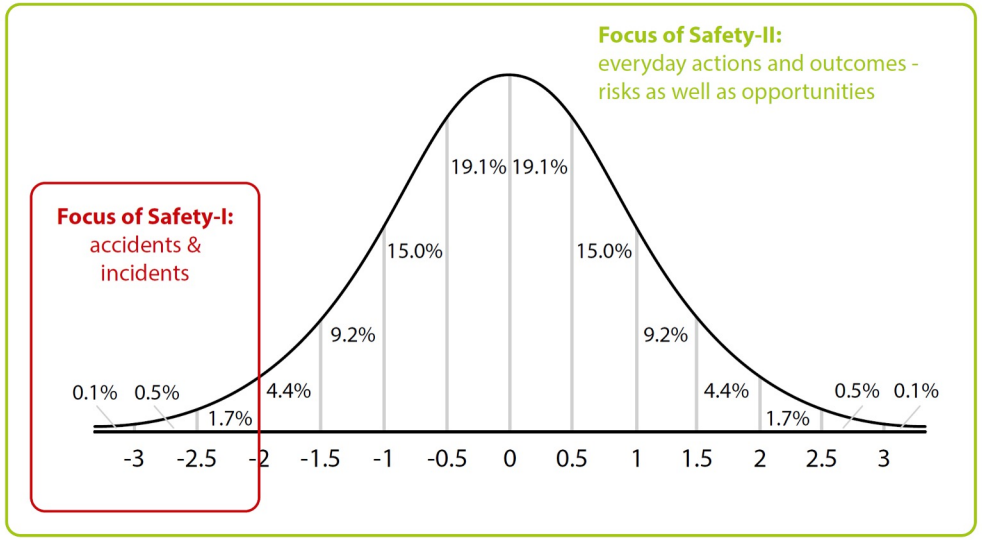
Safety I & Safety II

	Safety-I	Safety-II
Definition of safety	That as few things as possible go wrong.	That as many things as possible go right.
Safety management principle	Reactive, respond when something happens or is categorised as an unacceptable risk.	Proactive, continuously trying to anticipate developments and events.
View of the human factor in safety management	Humans are predominantly seen as a liability or hazard.	Humans are seen as a resource necessary for system flexibility and resilience.
Accident investigation	Accidents are caused by failures and malfunctions. The purpose of an investigation is to identify the causes.	Things basically happen in the same way, regardless of the outcome. The purpose of an investigation is to understand how things usually go right as a basis for explaining how things occasionally go wrong.
Risk assessment	Accidents are caused by failures and malfunctions. The purpose of an investigation is to identify causes and contributory factors.	To understand the conditions where performance variability can become difficult or impossible to monitor and control.



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Safety Definition

Safety is an intrinsic human need, and its meaning is evolving with the society.

Safety nowadays does not regard only the working place, the final product, the public health, or the natural environment, but also occupational issues such as comfort at work. Industrial (and not only) accidents that still happen prove the need for more careful safety approaches.

Safety is the dynamic **NON_EVENT**

Question: what does it mean the dynamic non event?
Question: why the meaning of safety is evolving through time?

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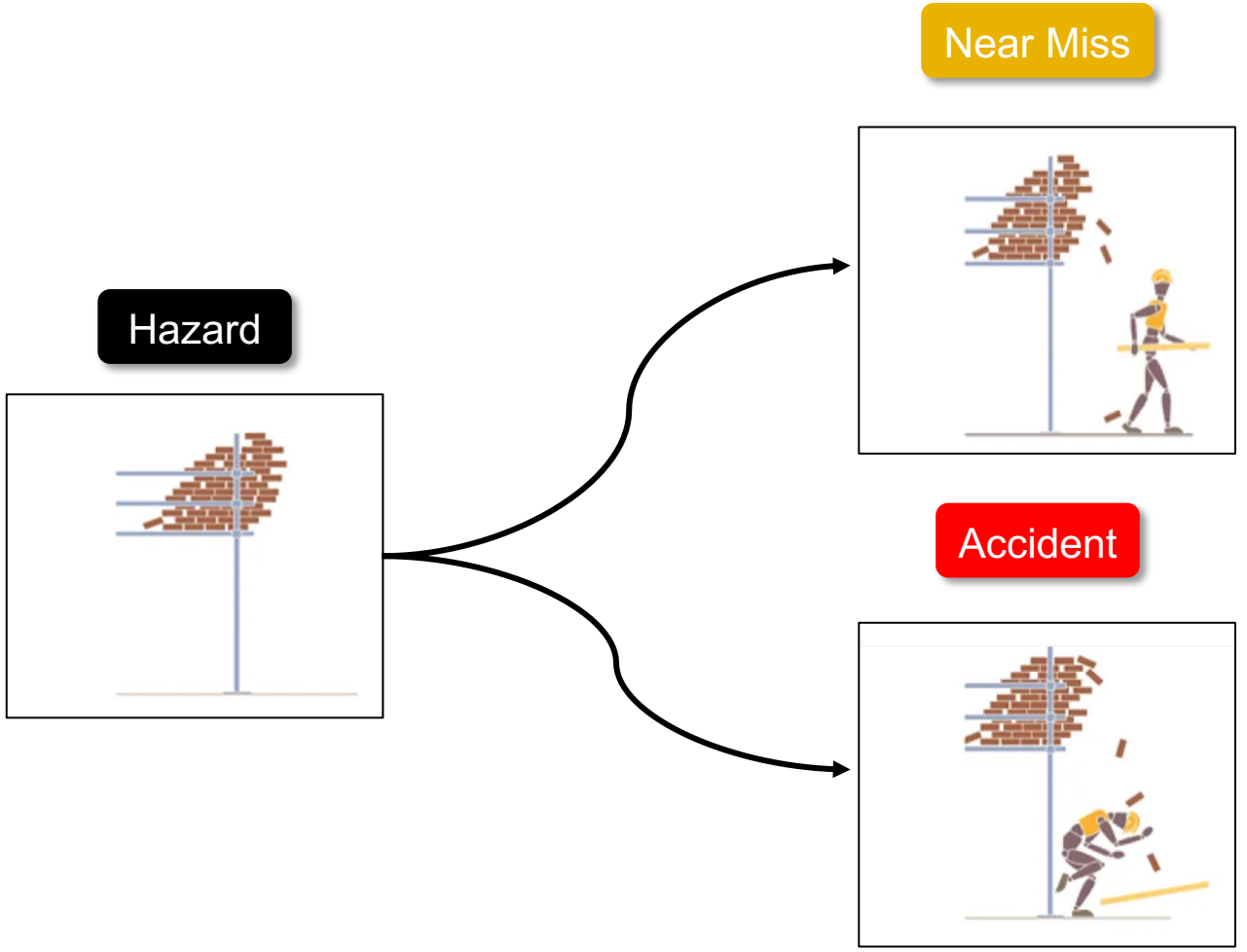
Near Misses

Near misses are not errors or failures, but they are indicative of the situation.



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Human Factors – Failure, basic taxonomy of errors

Errors - A human error is an action or decision which was not intended. Some errors are slips or lapses.

Mistakes – knowledge based or errors of judgement or decision-making where the “intended actions are wrong”.

Safety

Violation- intentional but usually well-meaning failures where the person deliberately does not carry out the procedure correctly. They are rarely malicious (sabotage) and usually result from an intention to get the job done as efficiently as possible.

Security

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Human Factors Definitions

The discipline that studies the **human's surrounding environment**

Human Factors-American school

Ergonomics-British (European) school

(Murrell, 1965-"the scientific study of the relationships between man and his working environment")

The relation between HFs and Safety:
Working in safety conceives a **dynamic relationship** between the working environment and the worker

HFs is the science of designing **the job to fit the worker**, rather than physically forcing the worker's body to fit the job (OSHA 3125)

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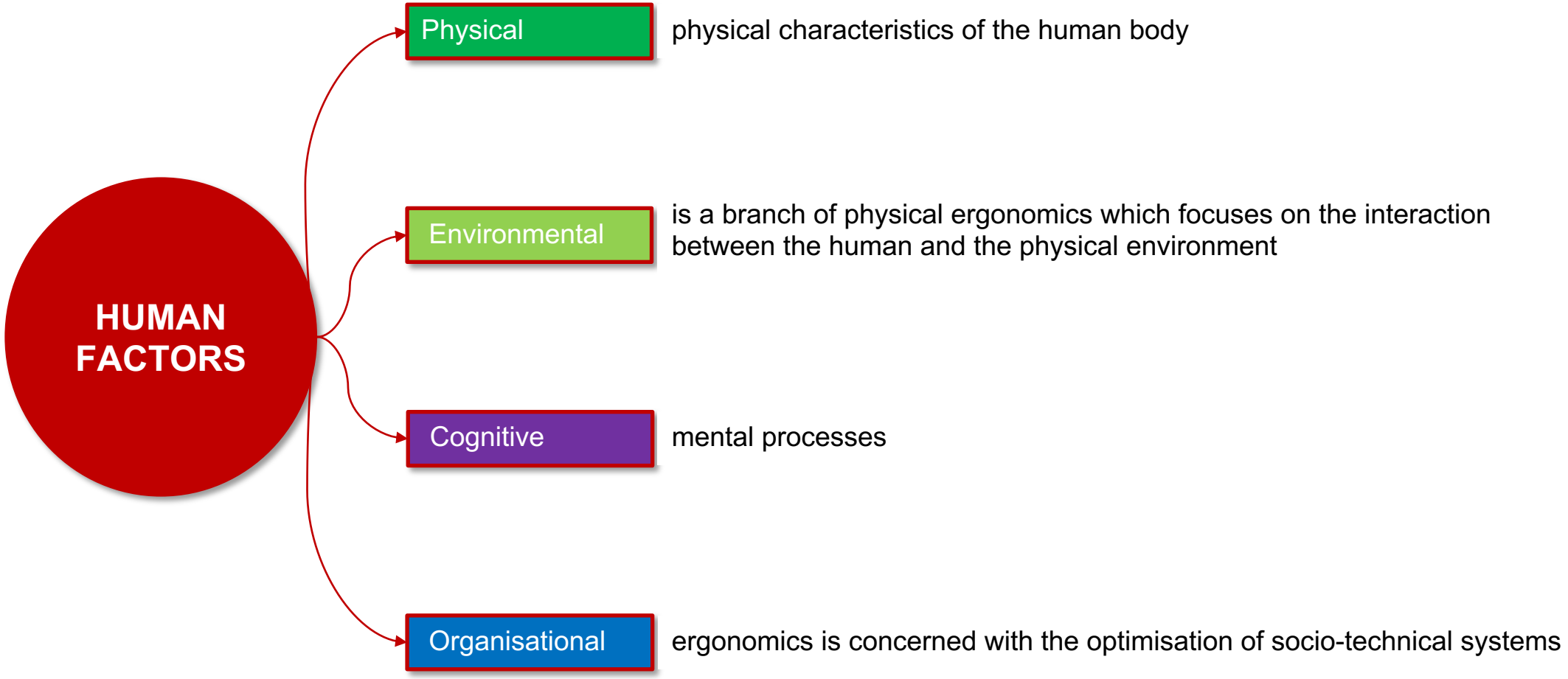
Human Factors and Ergonomics



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We need the following principles:

Anthropometrics: (body size, height, body proportions, etc)

Forces: forces applied for the task

Frequency: repetition

Design: design of the working space (confined? Adapted? Accessible? Universal? Etc.)

Question: do we all have the same size? How anthropometrics contribute to physical ergonomics if we are all different?

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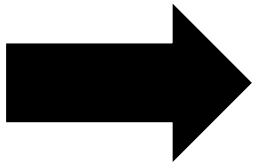
Cognitive HFs

Mental processes: thinking, perception, memory, etc

Memory: working memory, memory

Emotions and Feelings: boredom, alertness, sadness, frustration



Mental Fatigue: foggy mind, tiredness

Negative feelings

Stress

Overload

Burnout

Errors?

Question: is there any relation between cognitive and physical ergonomics? Do cognitive ergonomics principles apply to manual handling workers?

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Organisational HFs

Standards: ISO, OHSAS

Open culture principles: good communication

Safety culture? → Everybody is responsible for safety

Question: can we create safety culture with the adoption of specific safety standards?
Question: what is the relation of ergonomics to safety culture?

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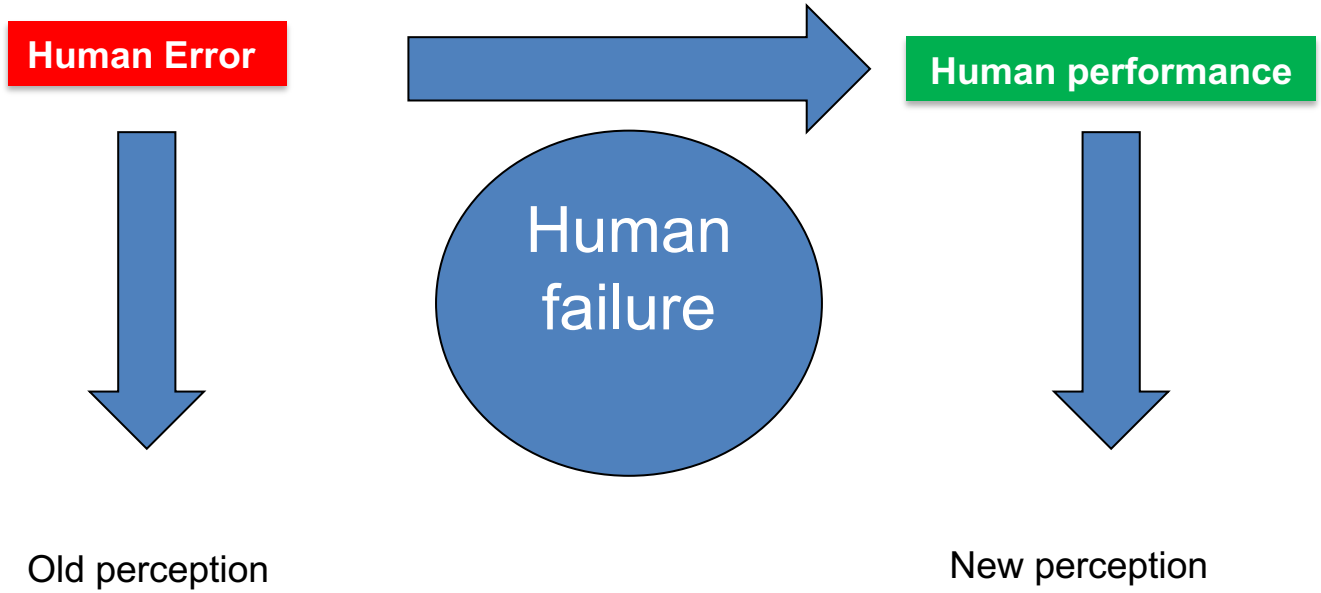
"Ergonomics is the design and engineering of human-machine systems for the purpose of enhancing human performance" (Dempsey et al., 2000)



Question: why do you think our society has changed from human error to human performance?

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Human Factors

"Human Factors" emerged from many disciplines, with none dominating completely.

HF is concerned with the application of what we know about human beings, their abilities, characteristics and limitations, to the **design** of equipment they use, **environments** in which they function and **jobs** they perform.

"Human Factors" is a distinct discipline, as well as a forum for other disciplines that share a similar focus.

Human Factors tends to have a design focus.

Human Factors, despite the name, is concerned with system performance, as a discipline and profession.

https://humanisticsystems.com/2019/04/24/human-factors-and-human-performance-whats-the-difference

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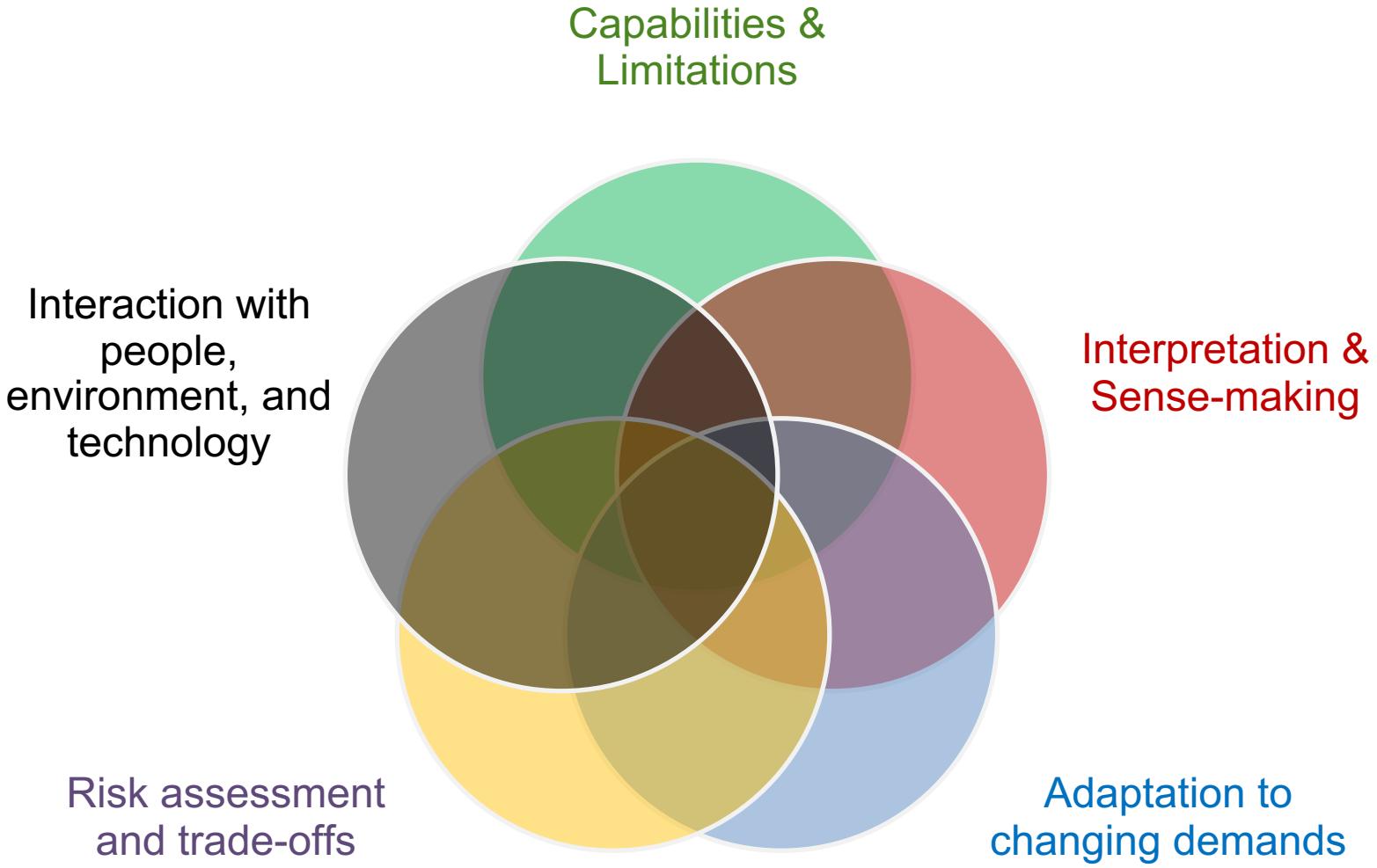
HP principles

- The five HP principles presented highlight key aspects of human performance.
- None of them operate in isolation.
- Recognizing that they overlap and interact gives us a richer, more multidimensional understanding of HP.



DOC 10151 – Human Performance (HP) Manual for Regulators, ICAO, 2021

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement N°814961.

Capabilities & Limitations

- Strength
- Flexibility
- Memory
- Attention
- Resourcefulness
- Creativity.

- Physiology
- Cognitive Constraints
- Heuristics
- Sensory Limitations
- Fatigue
- Psychology.

DOC 10151 – Human Performance (HP) Manual for Regulators, ICAO, 2021

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Interpretation & Sense-making

- People are always trying to make sense of the world around them. They look for patterns and predictability. Using the information available to them, they make conscious decisions and take actions based on **explicit knowledge** of facts and procedures as well as on **implicit knowledge** informed through experience, insights and intuition.

DOC 10151 – Human Performance (HP) Manual for Regulators, ICAO, 2021

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Adaptation to changing demands

- In complex systems, people are key to creating **resilience** by constantly adjusting and adapting to overcome delays, adverse weather and other unexpected situations.

- As a result of this continuous adaptation, the work actually performed by people is often different from how the work was originally expected to be performed. Rules, procedures, tasks and equipment are often designed and planned in an environment where a limited set of variables is considered. In the operational environment, work is performed under conditions in which not everything can be predicted or controlled.

- **People's ability to adapt** means that the system is more likely to recover from unexpected disturbances, resulted in **increased resilience.**

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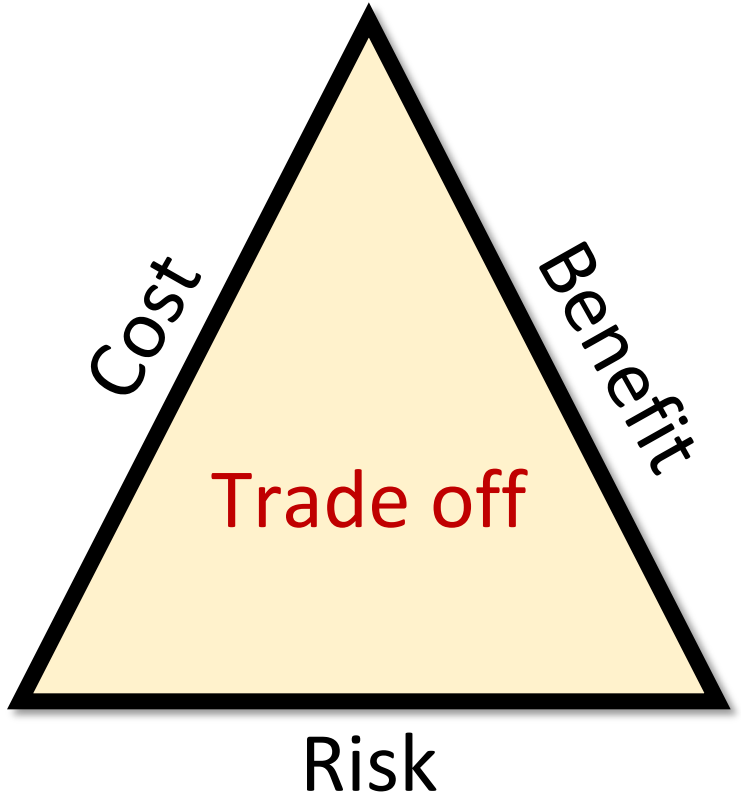
Risk Assessment and Trade-offs

- The work environment presents people with **conflicting goals**. Any activity must balance safety objectives and other organizational objectives, such as on-time performance, cost savings and environmental protection.

- For individuals, these conflicting goals can sometimes translate into difficult operational **trade-offs**: efficiency vs. thoroughness, speed vs. accuracy, cost vs. benefit, short term vs. longer term benefits, and personal vs. organizational goals.

- These trade-off choices are influenced by **personal beliefs, interests and motivations, as well as social, organizational, and cultural factors**. These choices are also influenced by the perceived incentives and disincentives in the system.

- Trade-offs can sometimes result in errors or in deviations from published rules or procedures. This flexibility might be perceived as a safety deficiency. However, procedures and rules are often prescribed in a limited context or for specific purposes, **and it is the responsibility of the people in the system to balance the risks and find the right trade-offs.**



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Interaction with People, Environment, and Technology

- Human performance can be positively or negatively affected by interacting with other people and with all elements of the **socio-technical system.**
- We learn and behave within the constructs of the **culture** we are brought up in and in which we live.
- Group and organizational cultures provide **the context** in which people work together.
- Even when provided with the proper equipment, procedures, guidance and training, people's performance is influenced by **interactions** with others, and everything around them, in ways that can vary from the expected result.

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Human Performance

The term "Human Performance" has become increasingly common in recent years in a number of industries, especially those with a safety focus.

Human Performance (HP) represents the human contribution to system performance and refers to how people perform their work.

“Human Performance” is not a distinct discipline, though it is a focus of, or umbrella for, allied human sciences.

Human Performance tends to have a behaviour modification focus.

Human Performance tends to be concerned with individual and team performance, as a focus for various disciplines and professions.

https://humanisticsystems.com/2019/04/24/human-factors-and-human-performance-whats-the-difference

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What are your takeaways up to now?

- **Safety** nowadays does not regard only the working place, the final product, the public health, or the natural environment, **but also occupational issues such as comfort at work**.

- Human factors (HF) encompasses knowledge from a range of scientific disciplines that support human performance (HP) through the design and evaluation of equipment, environments and work, in order to improve system performance.

- It is the responsibility of the people in the system to balance the risks and find **the right trade-offs**.

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Just Culture

- A significant contributor to the achieved safety level, is **the consistent learning** from mishaps and safety events to prevent recurrences.
- Frequently this leads to conclusions about people that have made errors of **operational**, **technical** or **organisational** nature.
- When the stakes are high, a natural response to faults and errors may be to look for the culprit and to punish them for putting our lives at risk. **The fear for punishment** that this brings about may in itself become a major reason why **systematic problems are left uncovered and uncorrected**.
- If we want these people to perform these jobs for us, **we must find a way to deal fairly and justly with the inevitable human errors.**

- *A Just and Fair Culture is where **people are clear about what the right and wrong behavior is**. They know when they cross the line and what the consequences could be. As professionals they have drawn that line themselves.*

https://safetyandjustice.eu/index.php/theory

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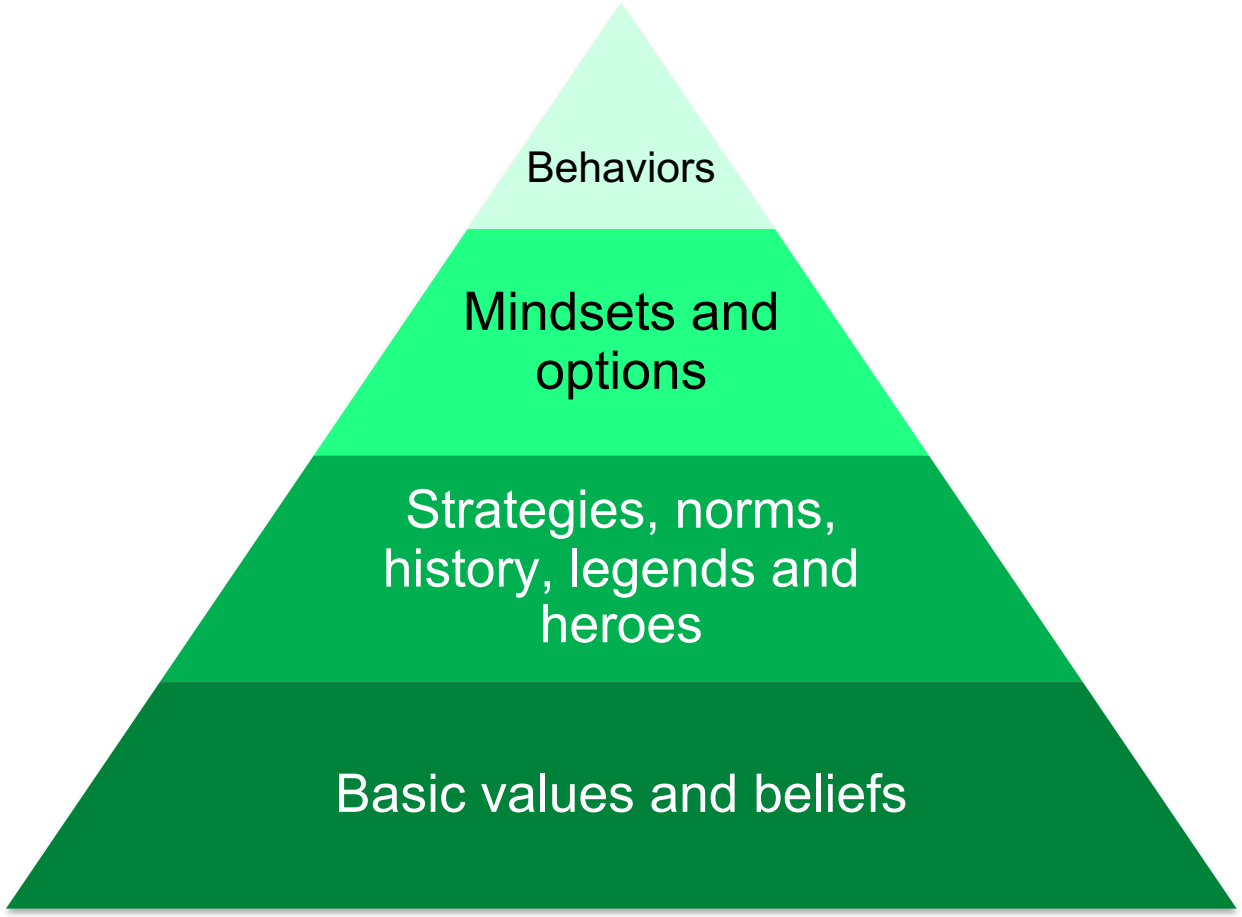
Safety Culture

What is "safety culture"?

"The safety culture of an organisation is **the product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour** that determine the commitment to, and the style and proficiency of, an organisation's health and safety management. Organisations with a positive safety culture are characterised by communications founded on mutual trust, by shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures."

ACSNI Human Factors Study Group: Third report - Organising for safety HSE Books 1993



Safety culture pyramid (Patankar, 2012, p. 2).

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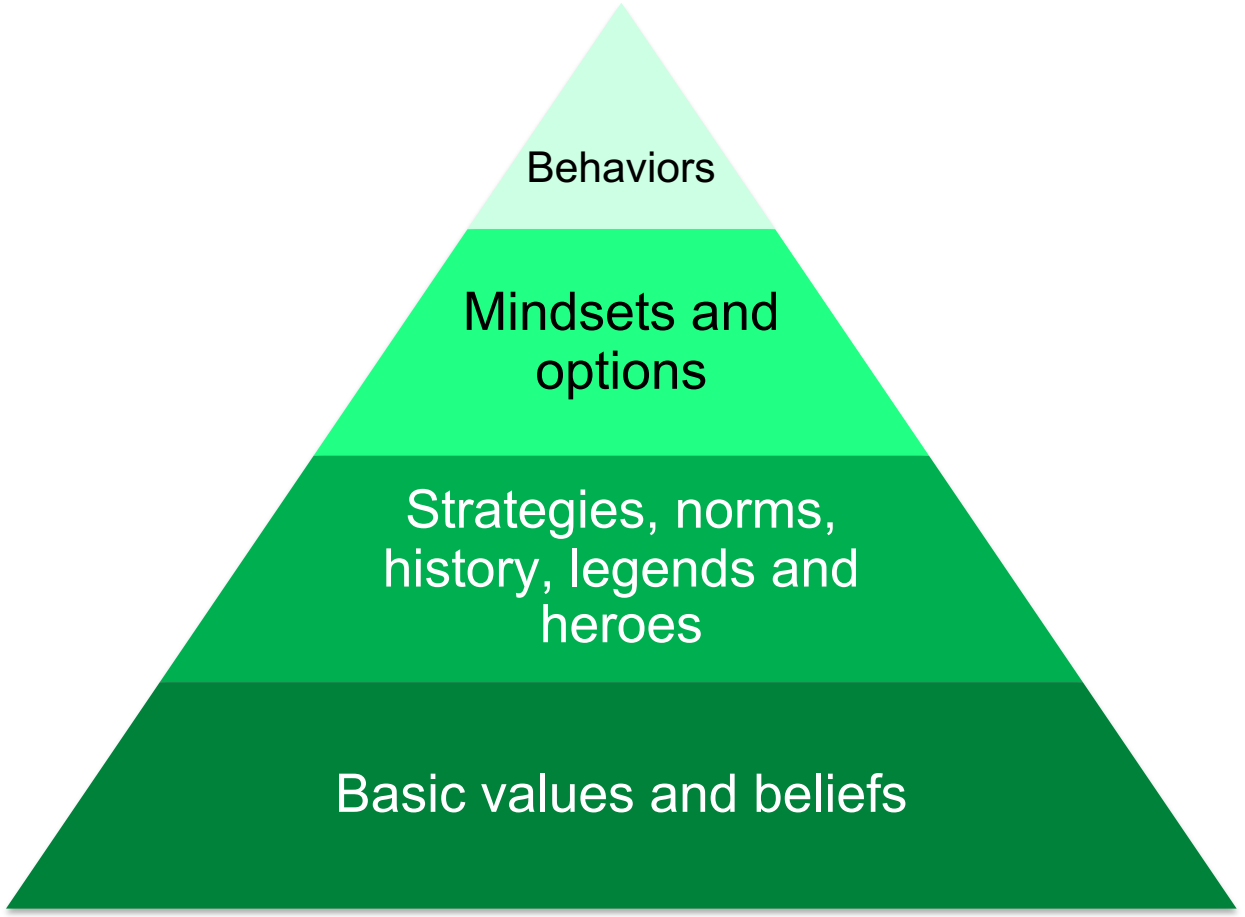
Safety Culture

Culture is can also be described as “the way we do things around here". Culture forms the context within which people judge the appropriateness of their behaviour, in this case, regarding safety. Related concepts of just culture and learning culture are also commonly mentioned in the maritime industry, but safety culture is the overarching concept.

MCA safety culture strategy, September 2021



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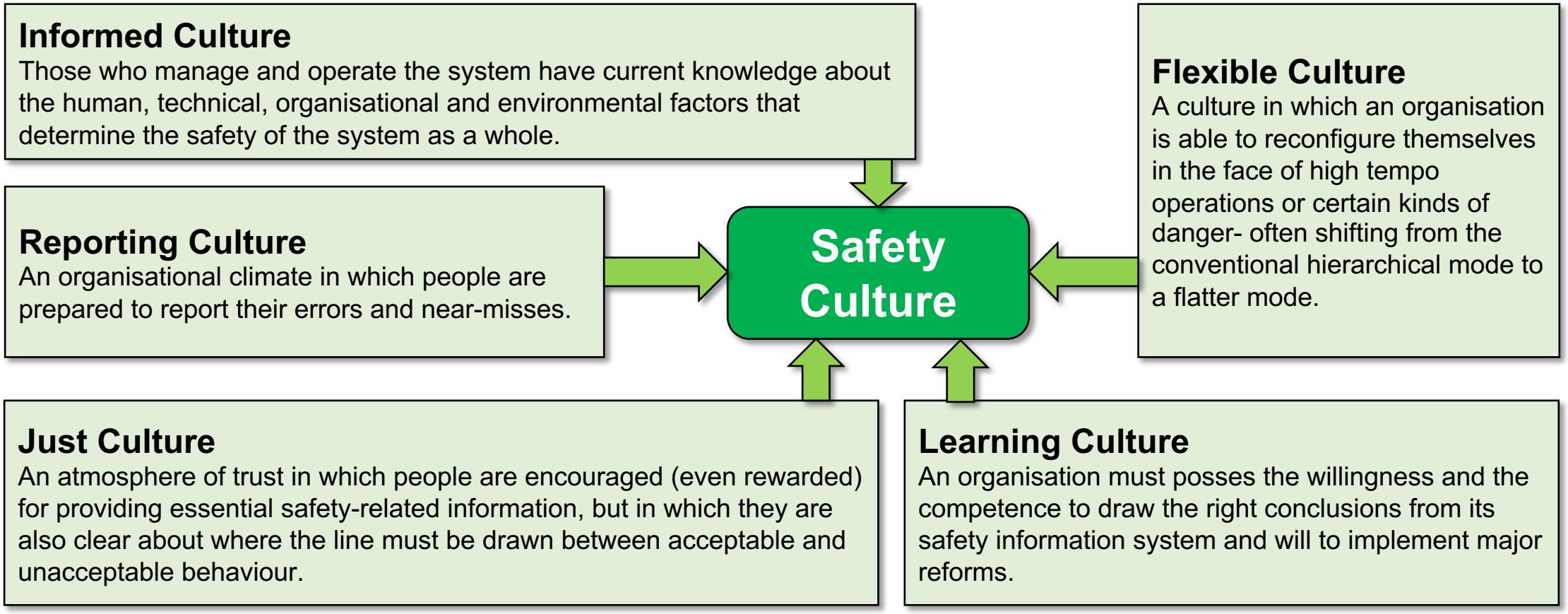
Safety Culture



Collegiate Aviation Program: A Systematic Assessment, Daniel Kwasi Adjekum, University of North Dakota

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Take Home Message

What messages will you take home from this presentation?

Remember

- Ergonomics and Human Factors regard aspect of people at work.
- Its ultimate aim is **not to fit the worker** to the environment, but **to fit the working environment to the worker**.

Everybody has the right to work.
Everybody has the right to be and feel safe.
Safety is a responsibility of everyone.
To err is human.
Human Performance can be improved with an optimal working environment.

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Take Home Message

Human factors (HF) encompasses knowledge from a range of scientific disciplines that support **human performance (HP)** through the design and evaluation of equipment, environments and work, in order to improve system performance.

- Human Performance is not a science
- Human Factors is a science
- Human Factors is a profession
- Human Performance is not a profession
- Human Performance is of interest to Human Factors and to many other disciplines (e.g. Sport)
- Human Factors has a design focus
- Human Performance has a behavioural focus

https://humanisticsystems.com/2019/04/24/human-factors-and-human-performance-whats-the-difference

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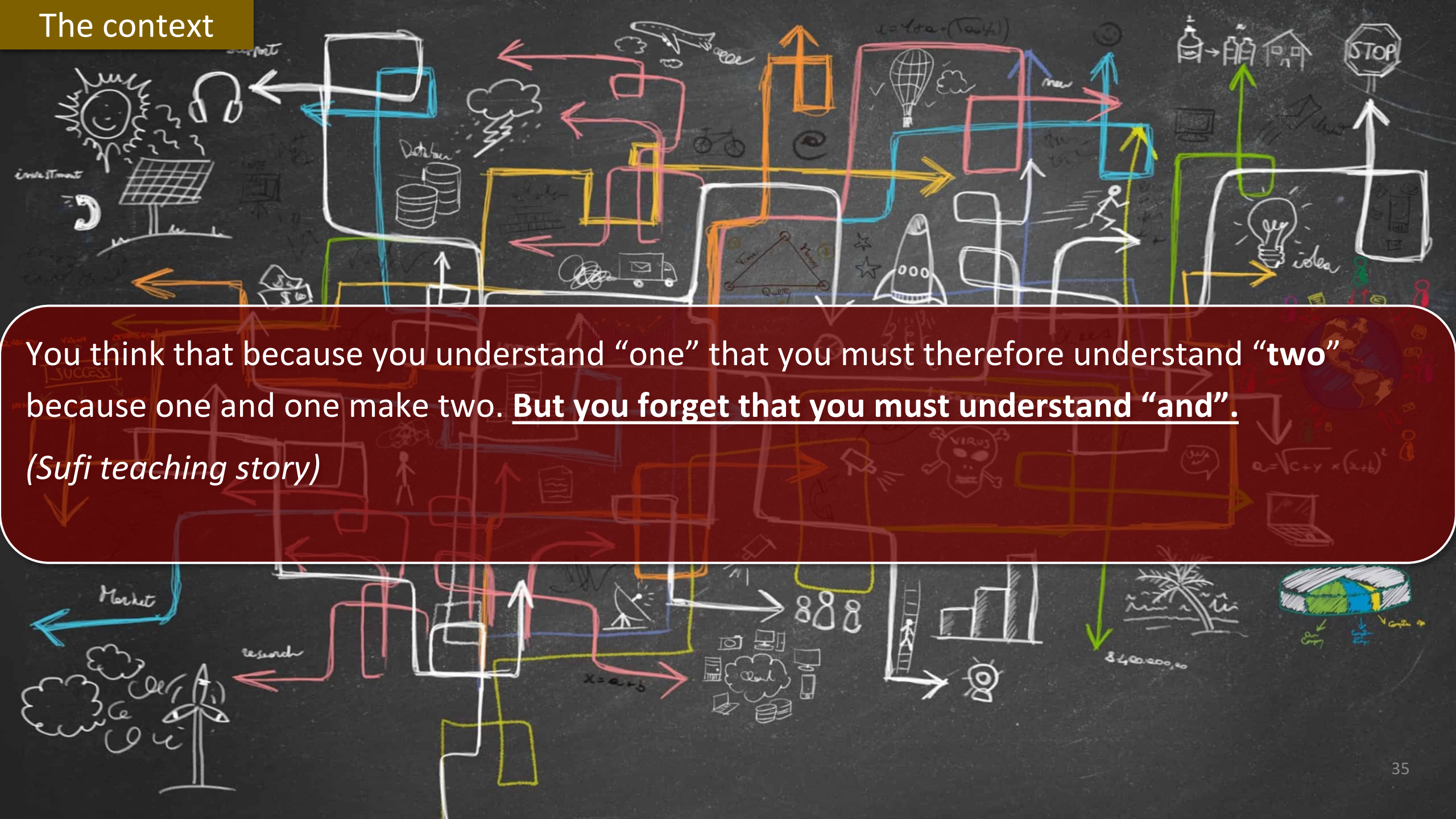
The context



You think that because you understand “one” that you must therefore understand “**two**” because one and one make two. **<u>But you forget that you must understand “and”.</u>**

(Sufi teaching story)

Thank you for your attention

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