

From **data** to **decision-making** under conditions of uncertainty

August 26th to 28th, 2025

RISK
Summer
School
2025



Risk Institute
Université Grenoble Alpes

DECODE Project

Decode stands for : DEvelop Compétences DEvoted to the management of uncertainty with creativity and drama tools



Swansea University
Prifysgol Abertawe



Risk Institute
Université Grenoble Alpes

RISK
Summer
School
2025

Integrating social and human data into risk assessment and management

Sandrine Caroly

Pr Ergonomics- PACTE Laboratory- UGA- France



UGA
Université
Grenoble Alpes



Program

- Human factor in accident
- Safety I and Safety II
- Resilience and collective activity – the role of Feedback

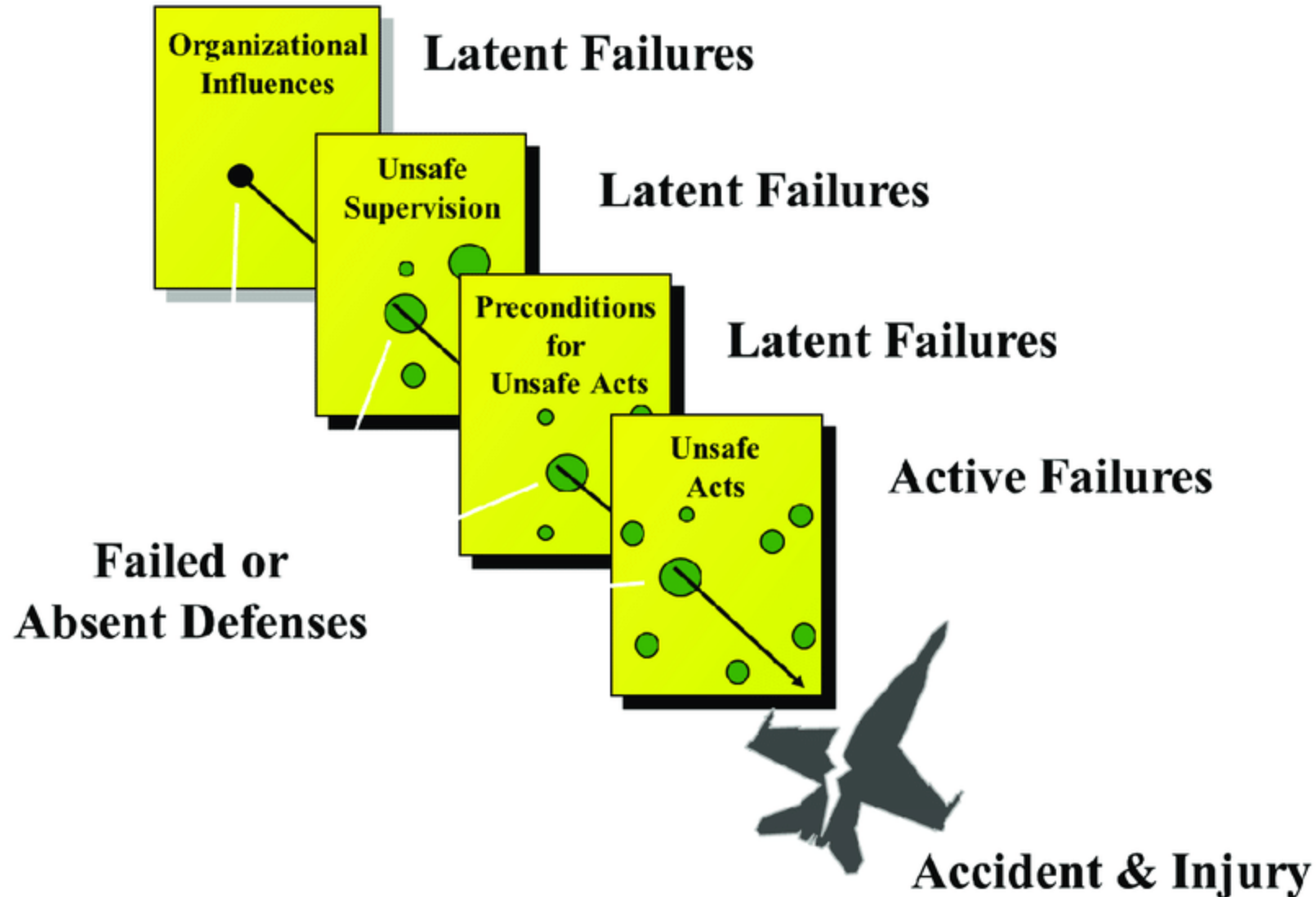
Types of data ?

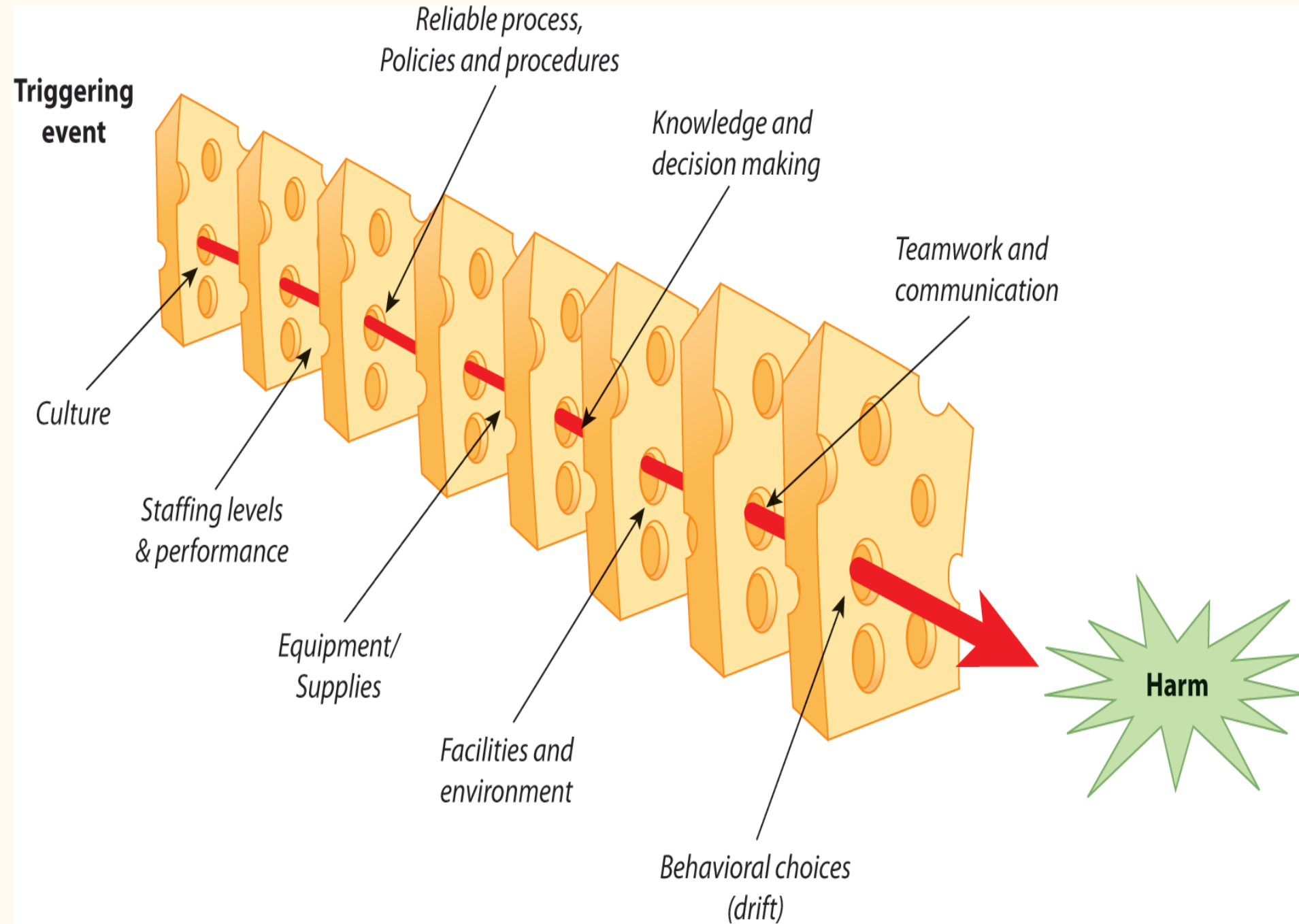
Introduction : Human factor in accident

- « a million accidents waiting to happen » (Wilson, 1986), almost none of them do.
- Here we examine why not?
 - organization concerned with efficiency:
 - Controlled information processing
 - Mindful attention
 - Heedful action
 - coordination, collective mental pocesses.

The technology is perfomed but not only.

Reason's Swiss Cheese Model





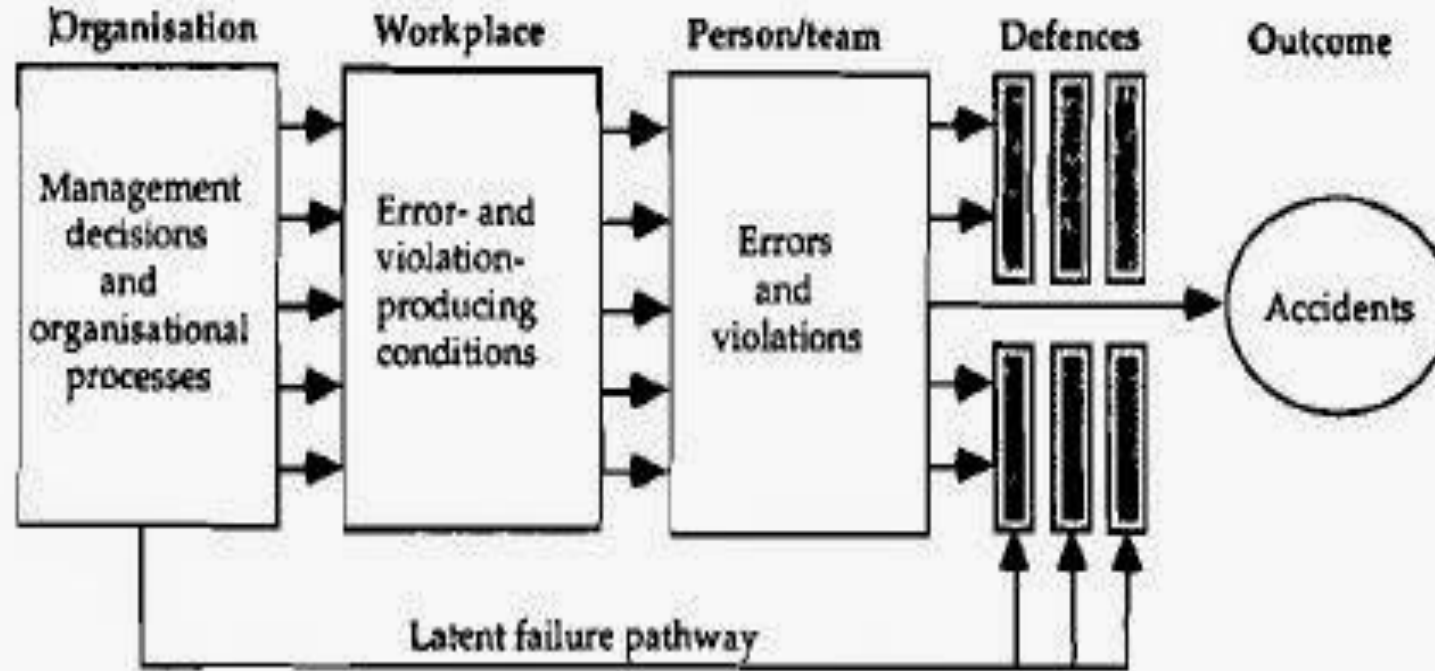


Figure 1. A model of organizational accident causation.

Examples:

Bopal, 1984

Challenger, 1986

Chernobyl, 1986

Mont Saint Odile, 1992

Toulouse AZF, 2001

Etc.



Age of technology

Age of human factors

Age of safety management

Age of cognitive complexity

1850

1900

1950

2000

Source: Erik Hollnagel, 2012 (modified)

AGE OF TECHNOLOGY

Humans as cogs in machine
Safety-I: what's going wrong

AGE OF HUMAN FACTORS

- Humans as hazards to be controlled
- Rules-based safety culture

AGE OF SAFETY MANAGEMENT

- Humans as heroes adjusting to varying conditions
- Safety-II: what's going right

AGE OF COGNITIVE COMPLEXITY

- Humans as storytellers
- Safety as an emergent property of a complex adaptive system

Event Identification

Categorization of events (with reference to other framework axes), e.g.

- External
 - Economic
 - Environment
 - Political
 - Social
 - Technological
- Internal
 - Infrastructure
 - Personnel
 - Process
 - Technology

Internal Environment

Objective Setting

Event Identification

Risk Assessment

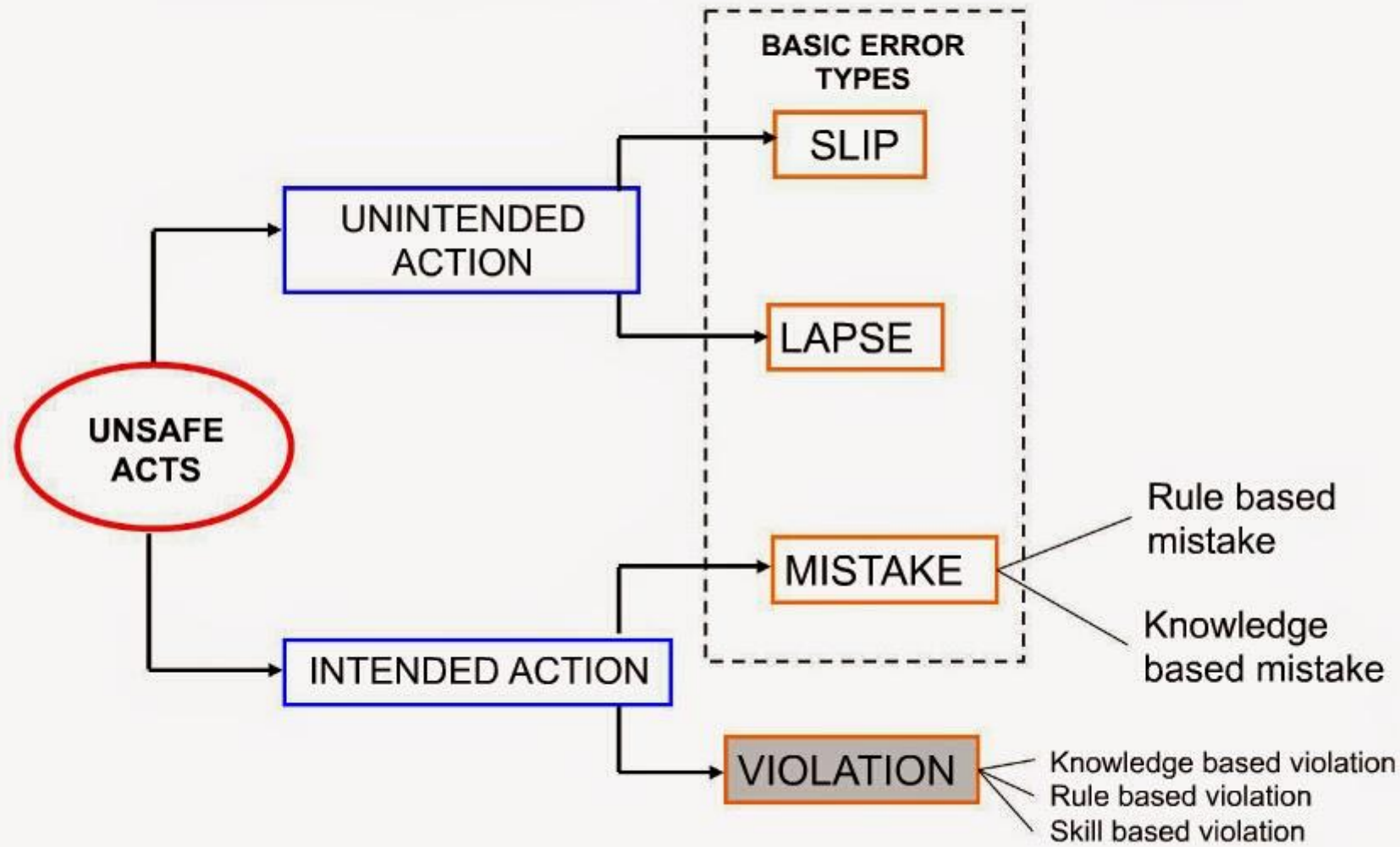
Risk Response

Control Activities

Information & Communication

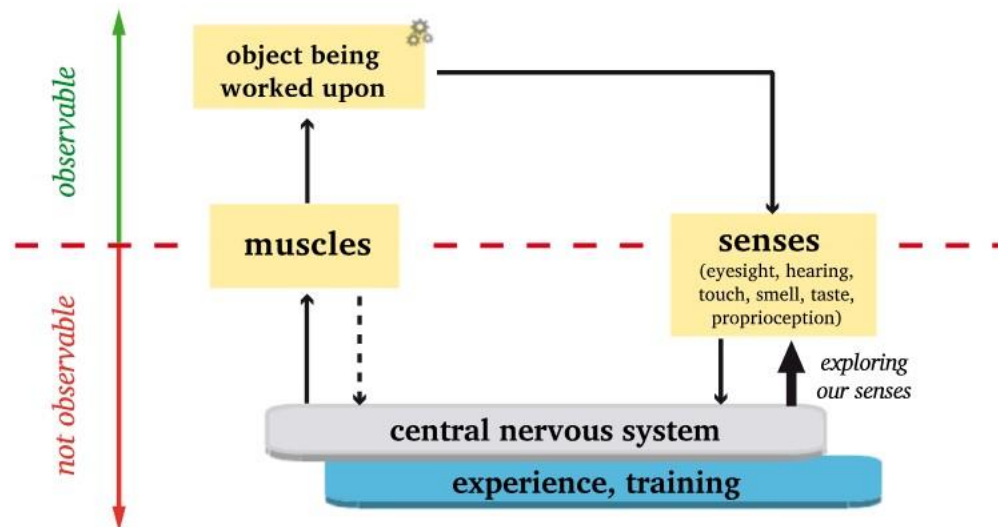
Monitoring

MODEL OF UNSAFE ACT



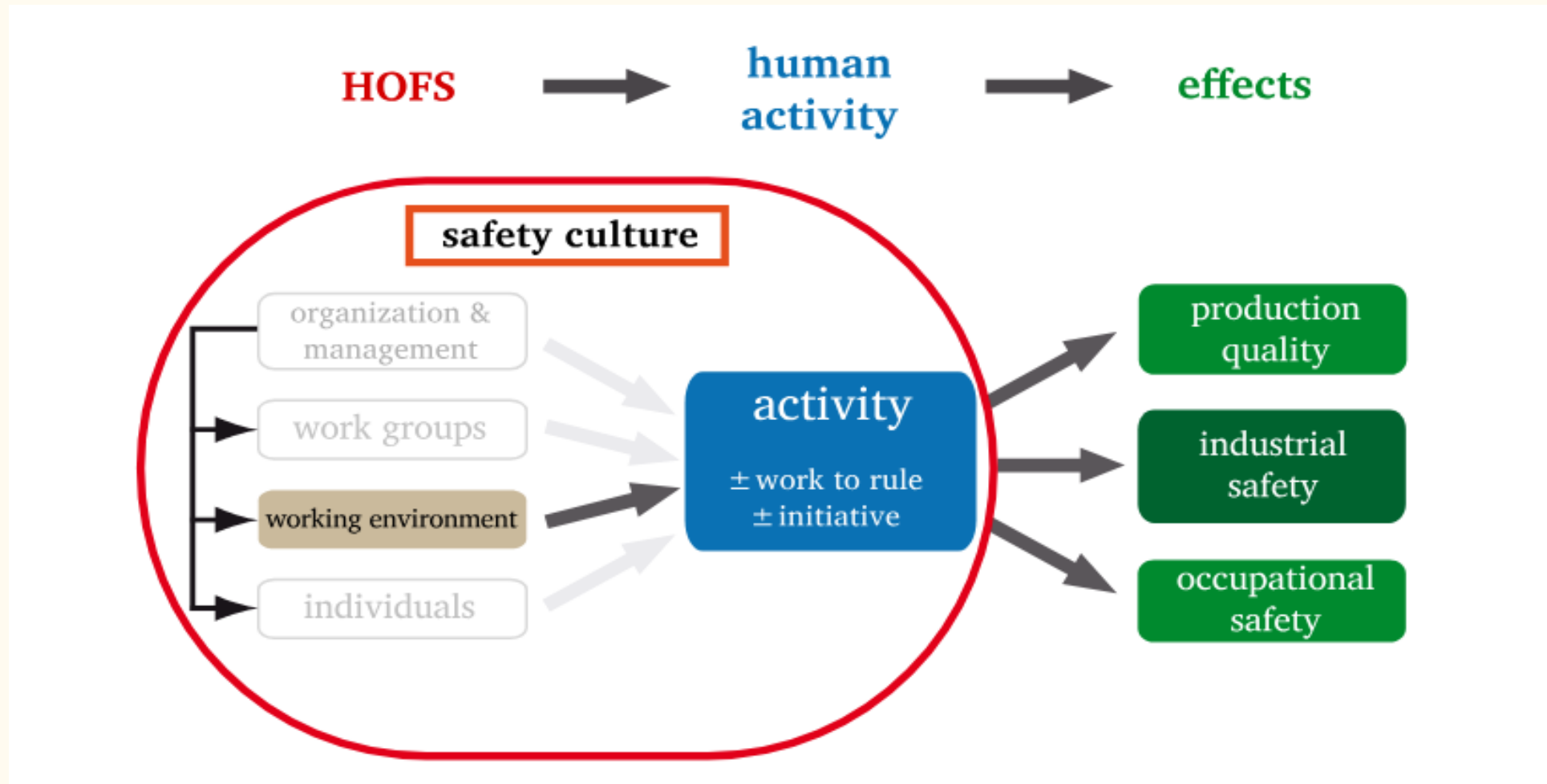
HUMAN AND ORGANIZATIONAL FACTORS OF SAFETY

- From “behaviour” to activity :
 - When some companies talk about “behaviour”, they mainly mean behaviour that is in line with prescribed rules
 - But this approach neglects a number of other types of behaviour, which demonstrate initiatives taken by operators
 - This difference in relation to the procedure cannot only be treated in terms of “nonconformity”: it requires understanding of the reasons that explain it.

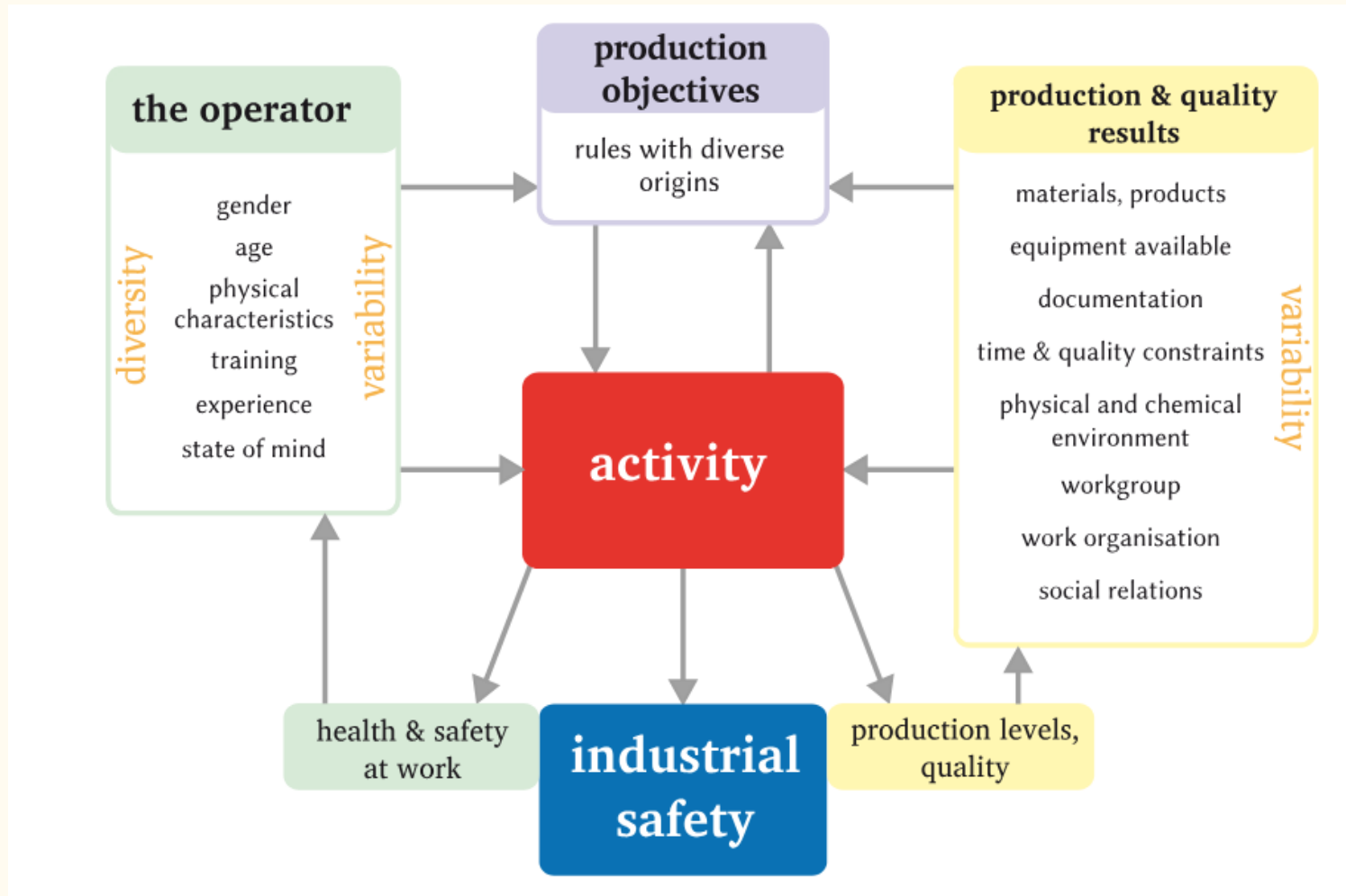


The methodology includes not only interviews, but also direct observation of behavior in real situations, followed by self-confrontation interviews

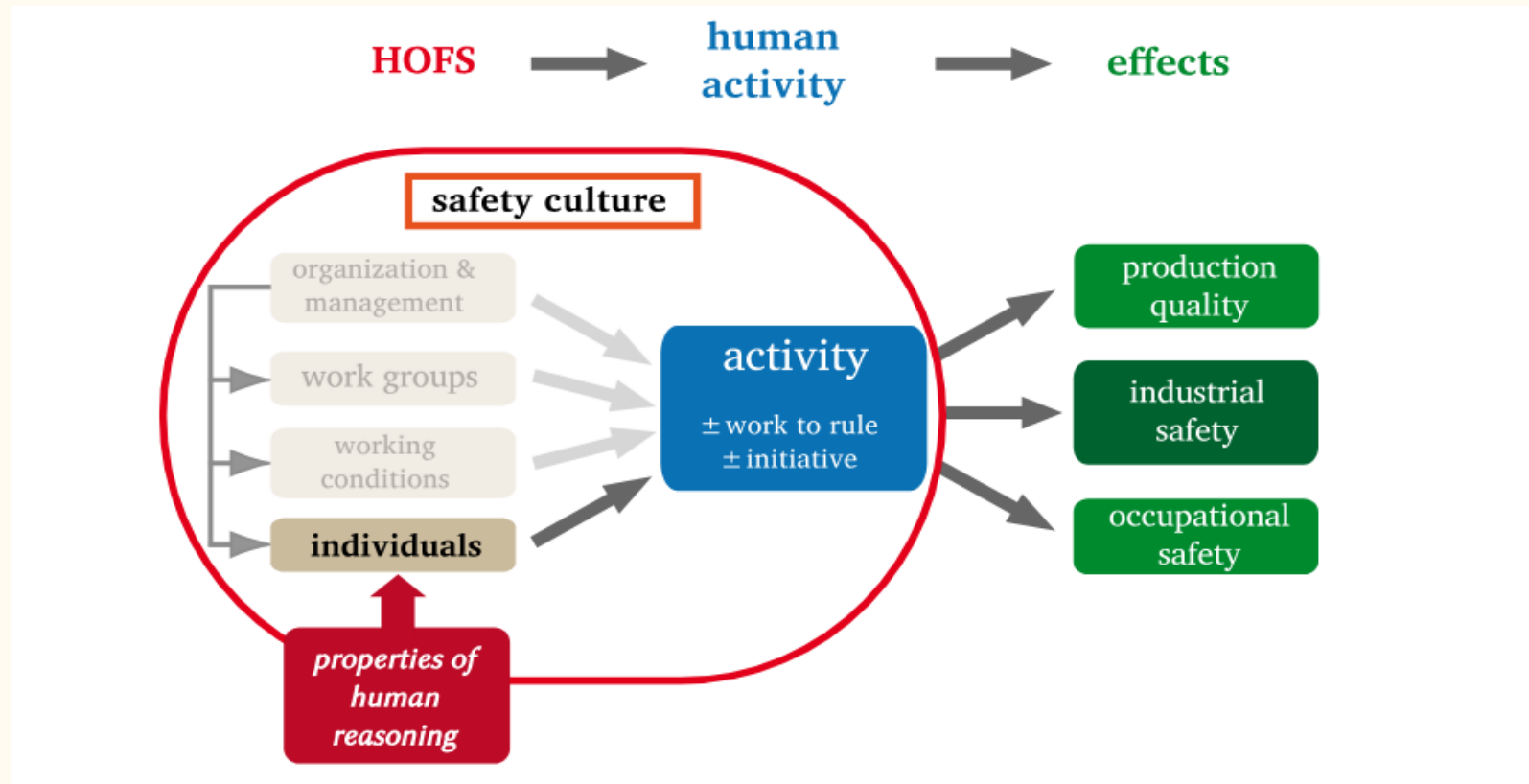
The working environment influences behaviour



The components of the working environment



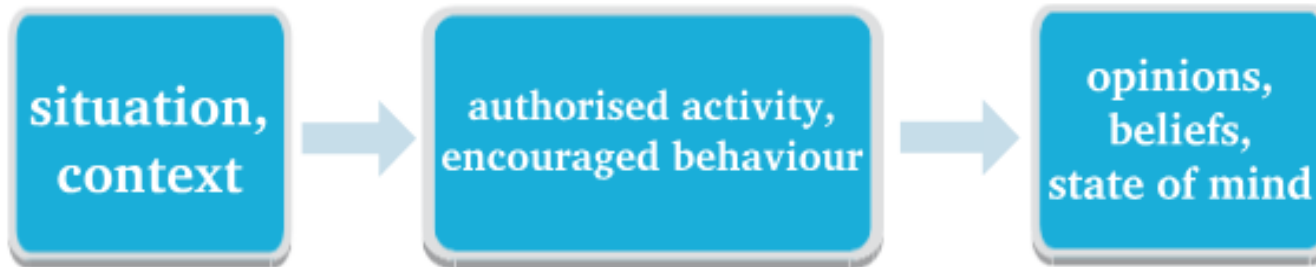
The brain and human reasoning



Situational awareness
Mental model
Differing perceptions

The link between actions and opinions

The links between convictions and actions are therefore not only in the direction:



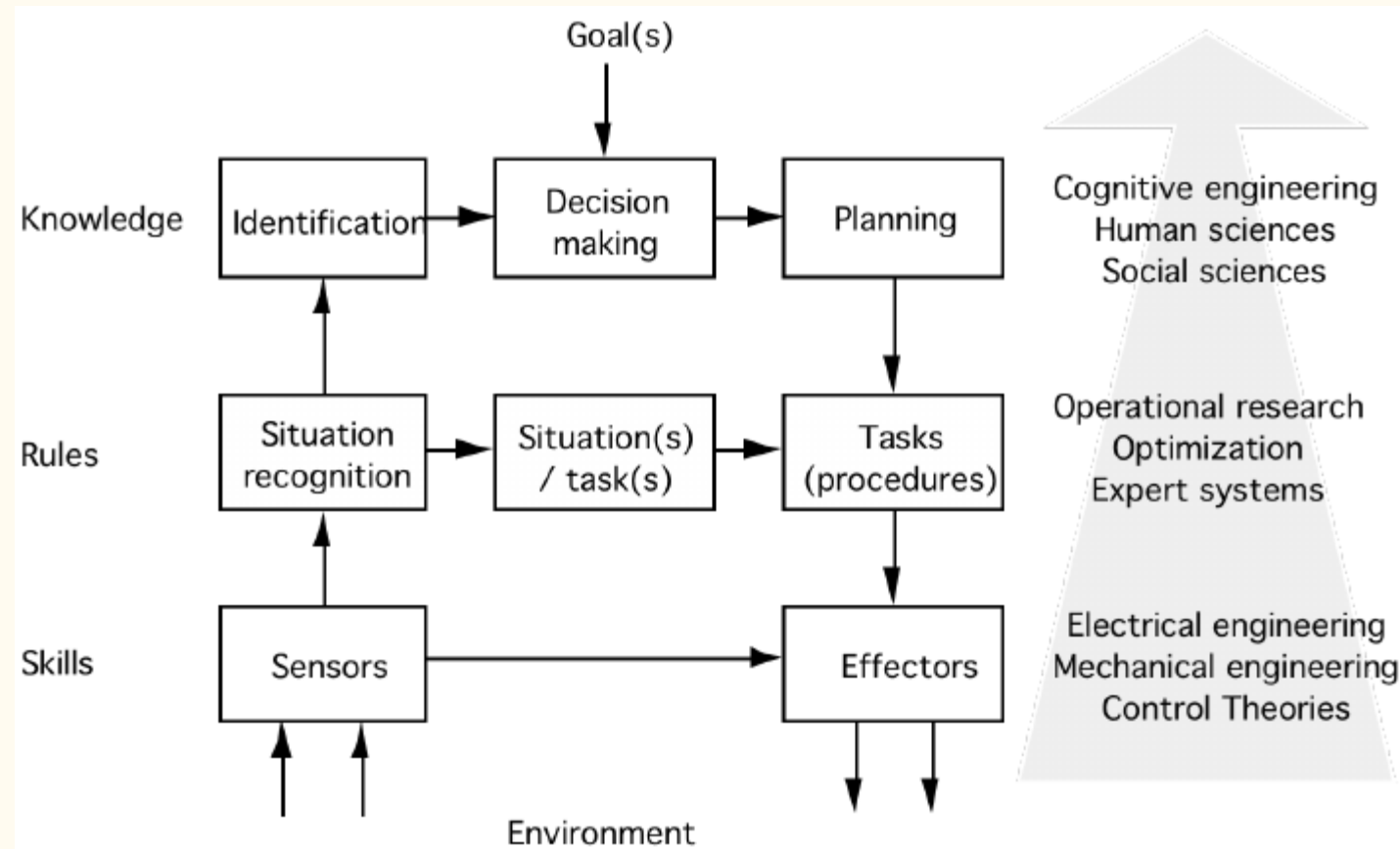
3 types of bias (Kouabenan, 2002)

- **Motivational Biases**
 - Driven by self-protection, self-esteem, and the desire to envision or contribute to a better world.
- **Cognitive Biases**
 - Result from suboptimal information processing, selective attention, causal reasoning, perceived control, unrealistic optimism, superiority bias, and the illusion of invulnerability.
- **Normative Biases**
 - Reflect cognitive functioning shaped by social norms, conformity, moral considerations, and the pursuit of social desirability.

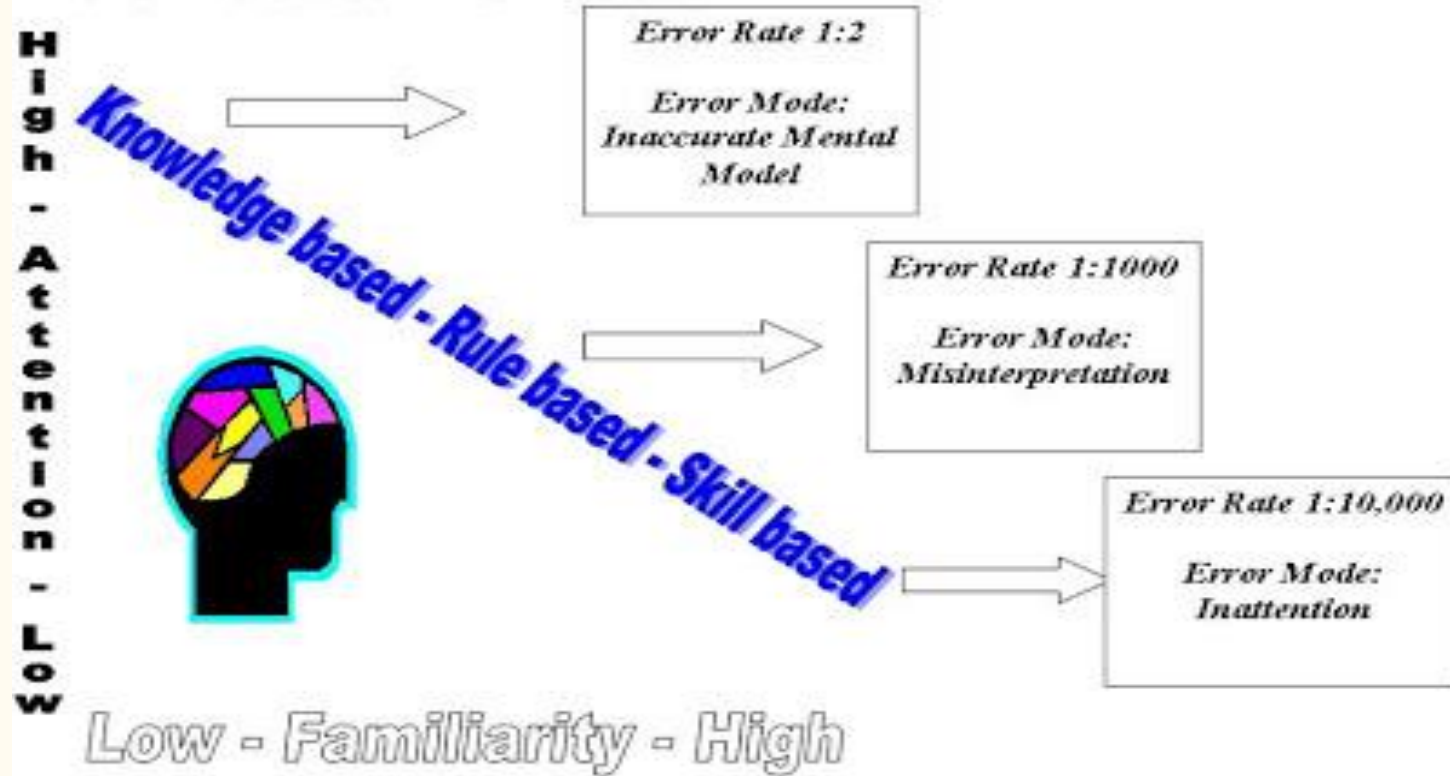


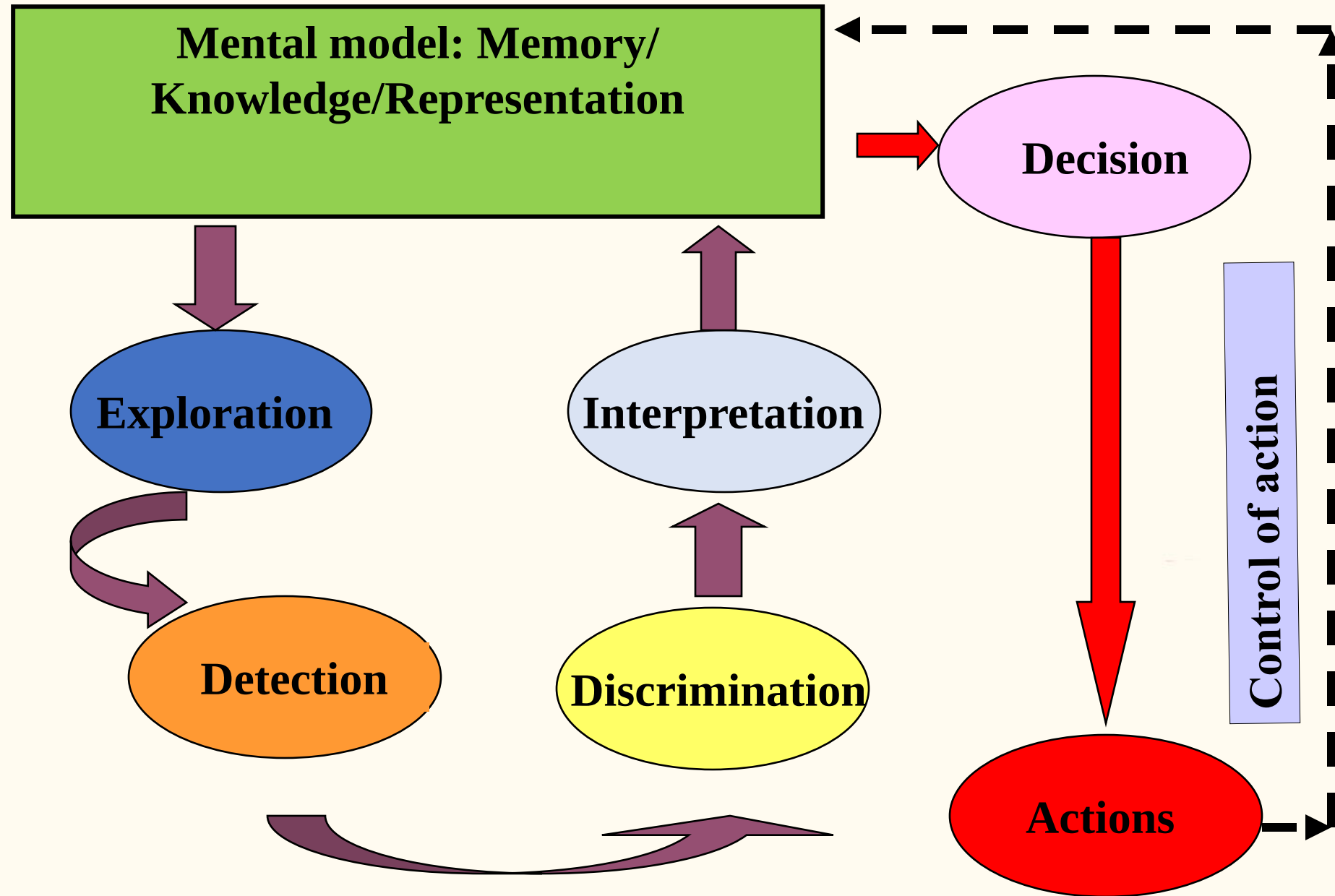
Behaviour account for experience, skill and familiarity

Rasmussen (1986)

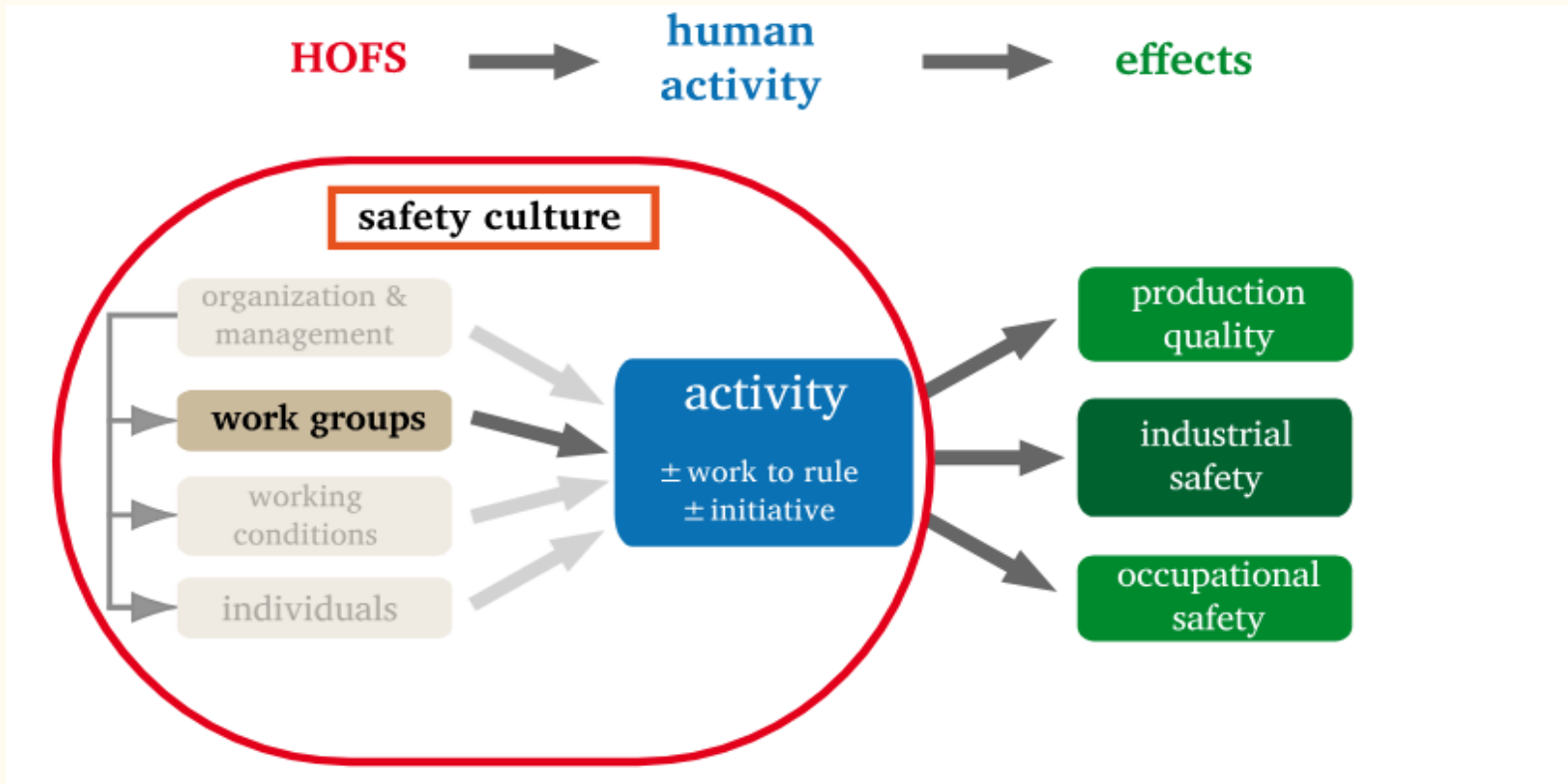


Rasmussen's Model





Collective activity



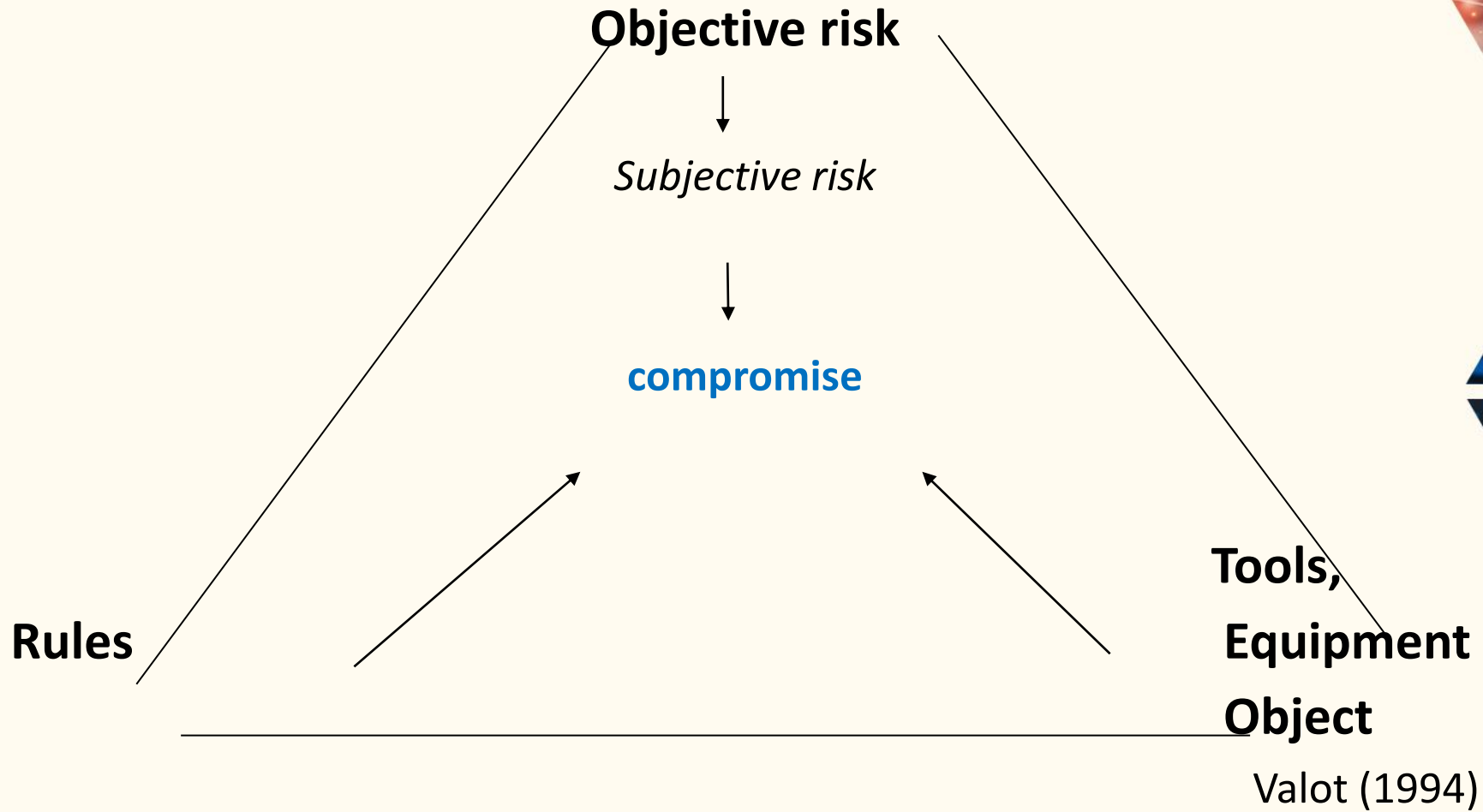
Collective Work and Work Collectives

- Shared intermediary objects
- Common goals
- Mutual support and collective regulation mechanisms

From Safety 1 to Safety 2

- Limitation 1: causal analyses are focused upon what is negative, overlooking positive dynamics or successful processes.
- Limitation 2: Causal analyses are unavoidably shaped by cognitive, methodological, and contextual biases, which influence how causes are identified and interpreted.

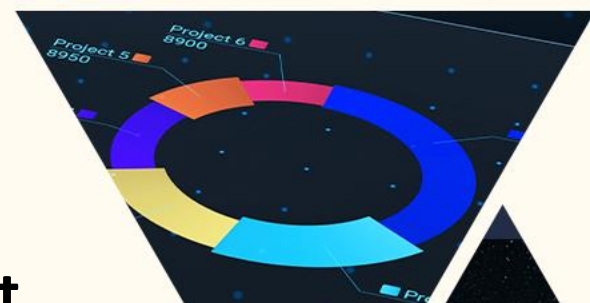
Global risk management model



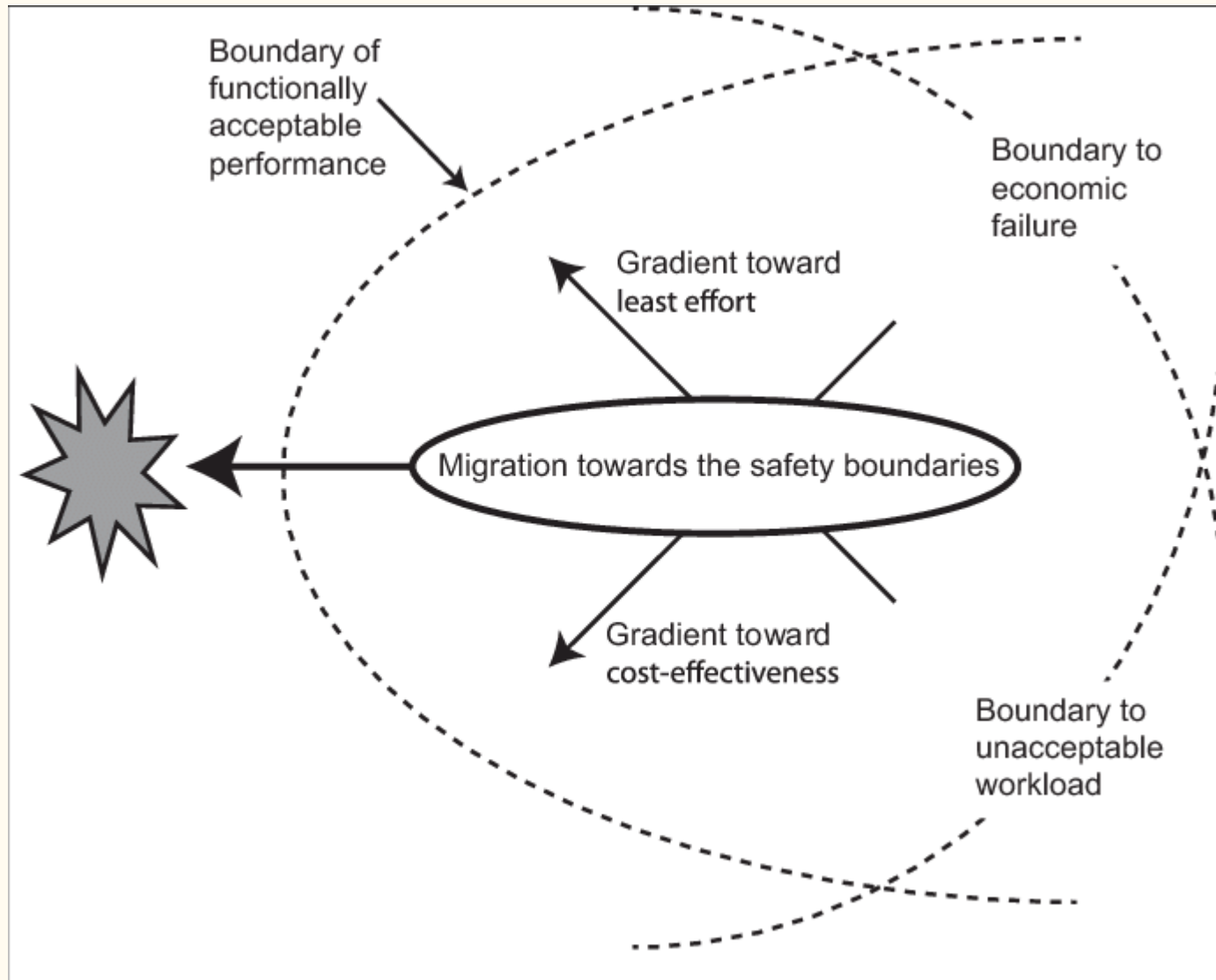
RISK
Summer
School
2025

RISK
MANAGEMENT

%

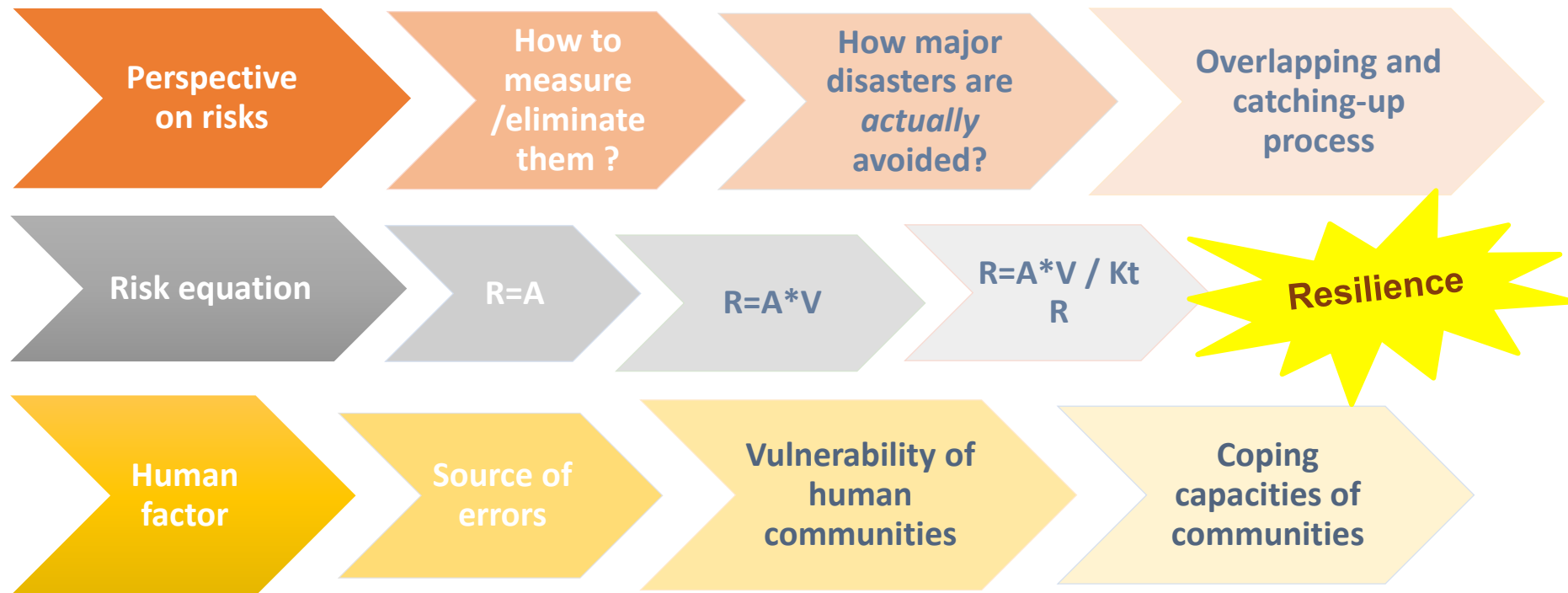


A process of migration to explain how accident can occur (Rasmussen, 1997)



The concept of resilience: a paradigm shift in the risk approaches?

Two heuristic shifts converging



Conclusion of social and human data in risk assessment and management

- Investigate technical systems, procedures, management systems, and work organization to understand behaviors.
- Analyze the roles of actors, power dynamics, and cooperation between stakeholders.
- Explore cognitive aspects of decision-making.
- Examine the trade-offs and operative strategies between “safety regulated” (safety 1) and “managed safety” (safety 2)
- **Methodology:** Behavioral observation and individual or collective self-confrontation (feedback of accident or real situation observed, or serious game).