ECEMP IGS

Leibniz Institute for Solid State and Materials Research Dresden

Coping with (human) errors in organizational and industrial settings

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Introduction of topic and speaker

Error Culture in Hospitals

Dr. Nils Löber

- Studies of business administration (KU Eichstätt-Ingolstadt)
- Consultant for Helbling Management Consulting
- Promotion at the KU Eichstätt-Ingolstadt
- Various publications on error culture, error management and patient safety
- Currently
  - Consultant for Detecon International
  - Industry focus on: Telco & utilities
  - Topic focus: Customer relationship management (CRM), CRM strategy, process re-engineering, change management

Agenda

- Introduction
- Why do humans and socio-technological systems fail? A view on error and accident causation theories
- Errors types and possible effects
- Coping with errors: Safety and error culture
- Conclusion

Human errors are omnipresent. Most of the times they remain without effects, but in specific settings they may endanger the life and well-being of others.

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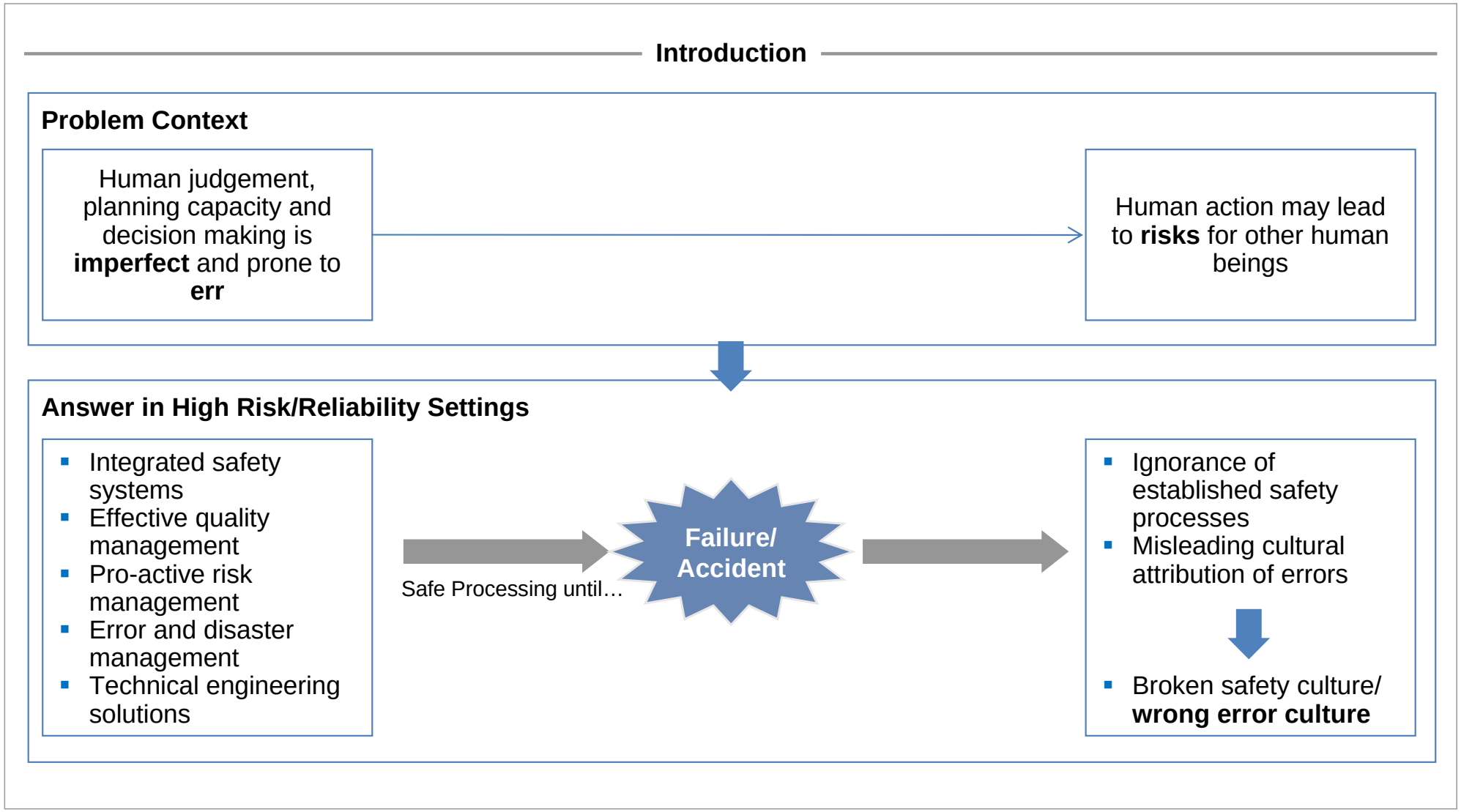


There exist two approaches for the explanation of human fallibility: The person and the system approach.

Person Centered View

- Focus on the human individual as sole source of unsafe acts
- Humans commit errors due to aberrant mental processes, such as
  - Physiological and biological factors (e.g. stress or fatigue)
  - Knowledge- and skill-based factors (e.g. poor training or lack of experience)
  - General information processing deficiencies (e.g. selective attention or omission)
- Exclusion of other situational factors
- Unsafe acts are the individual responsibility

Typical associated counter-measures

- Naming, blaming, shaming
- Change behaviour through training (to reduce unwanted variability in human behaviour)
- Remove/exchange the individual

System Approach

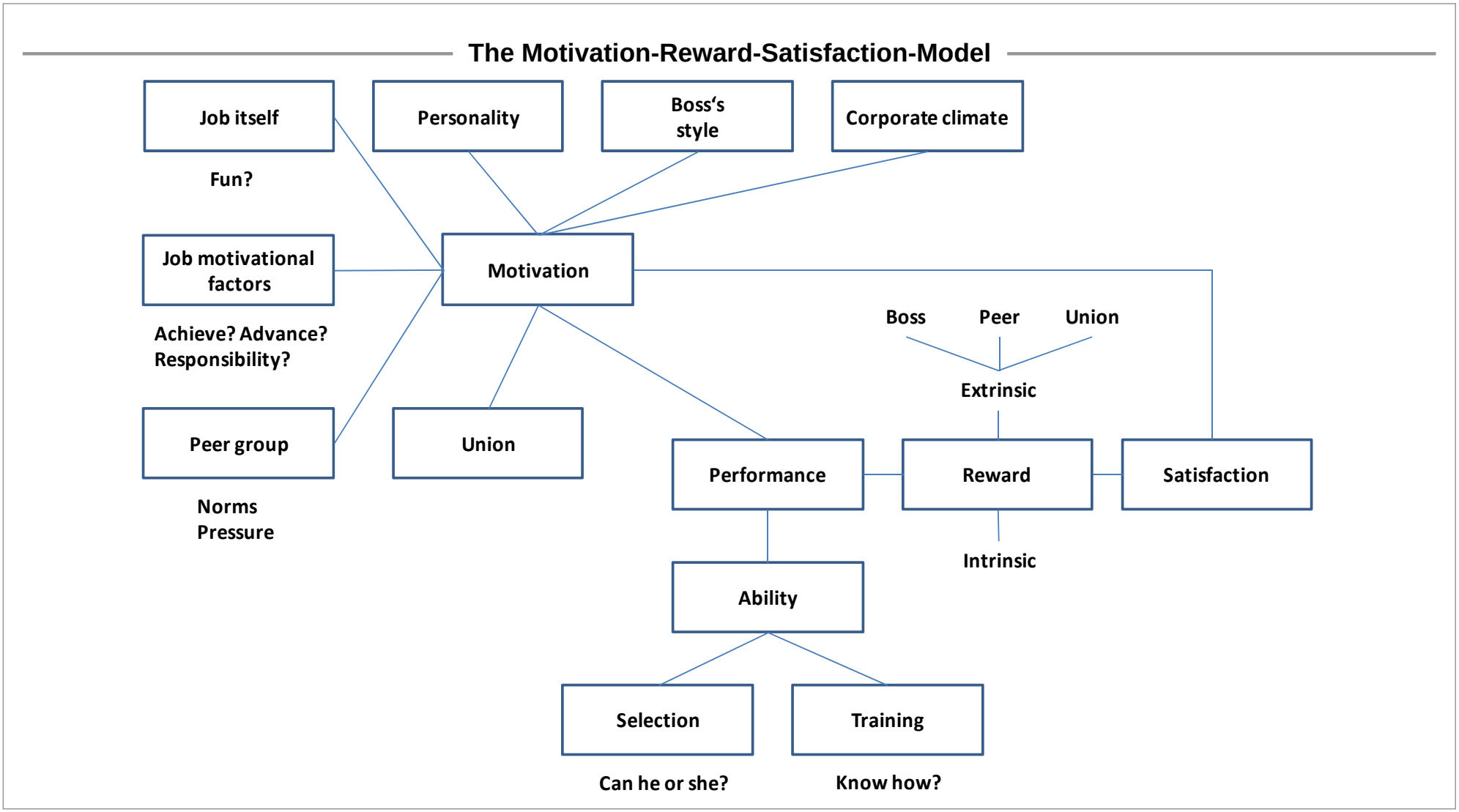
- General assumption that human beings are fallible and errors have to be expected
- Errors as consequences rather than causes
- Focus on factors that influence errors
- Complexity of modern socio-techonological systems as error origins
- Explanation of unsafe acts and settings through
  - Working environment (e.g. workforce availability)
  - Team factors (e.g. communication flow)
  - Work-related factors (e.g. availability of materials and resources)

Typical associated counter-measures

- Improve conditions of work
- Install/improve system defenses and safeguards
- Change mental mindset/ culture of individuals

Source: Adapted from Reason, J.T. (2000): Human Error: Models and Management, in: British Medical Journal, Vol. 320, Nr. 7228, p. 768–770.

A typical person-oriented approach for explaining errors and accidents are process-oriented motivation theories.



Source: Petersen, D. (1982): Human-Error Reduction and Safety Management, New York, p. 94.

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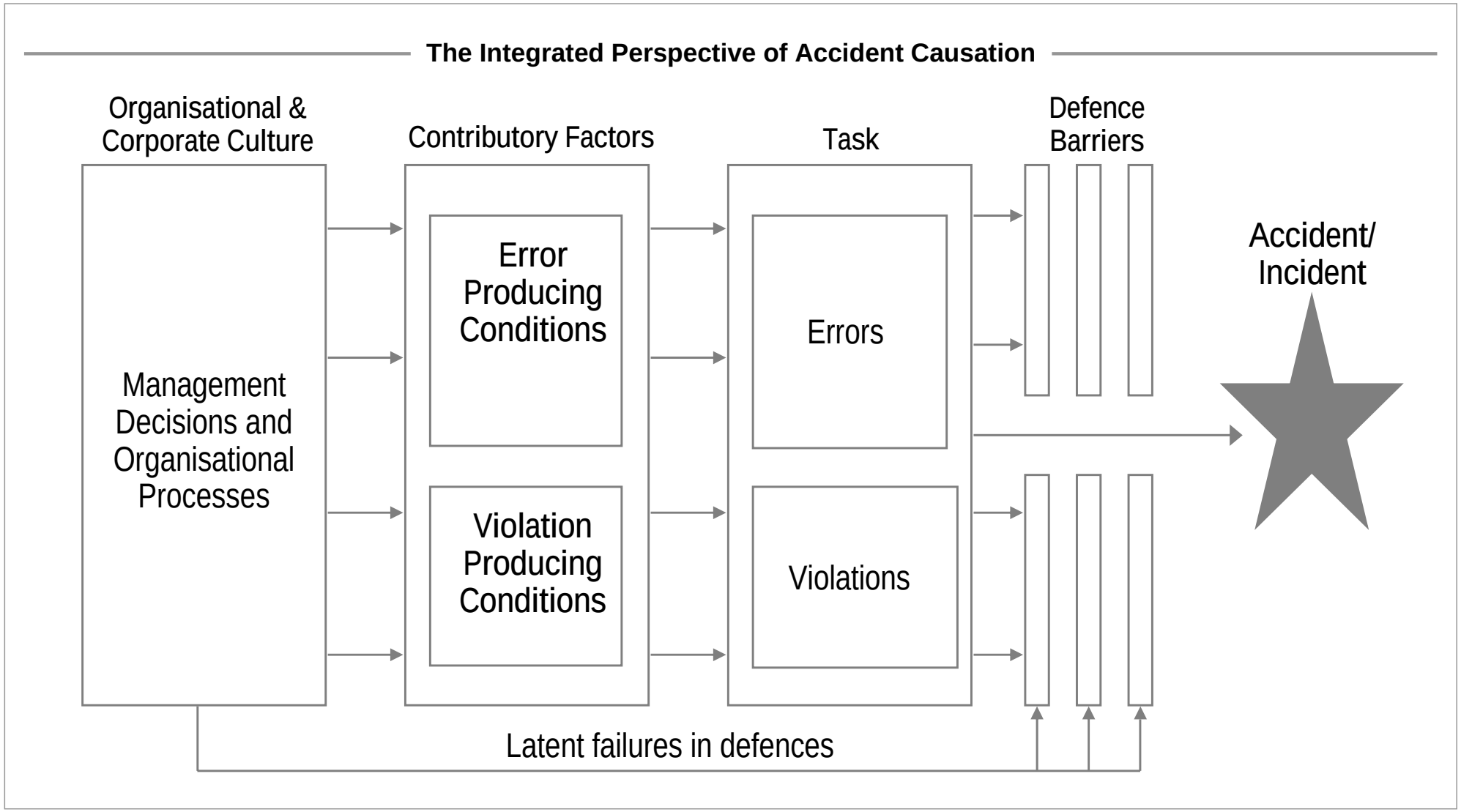
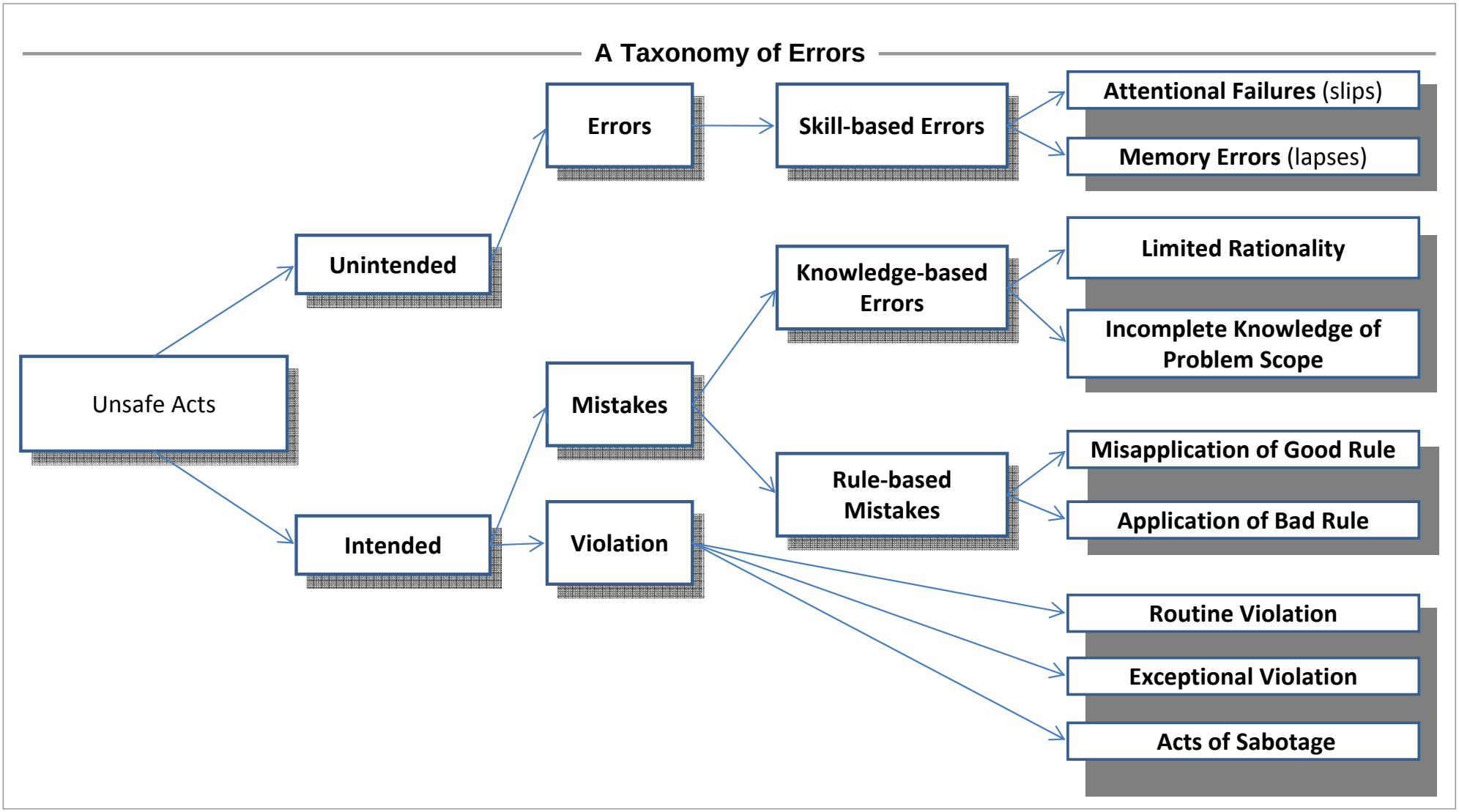
The systemic/integrated perspective incorporates organisational factors and their possible failures to explain accident causation.



Source: Adapted from Reason, J.T. (1994): Menschliches Versagen: Psychologische Risikofaktoren und moderne Technologien, Heidelberg, p. 256.

Unsafe acts committed by human beings may be triggered by a vast variety of individual factors.



Source: Adapted from Hofinger, G. (2008): Fehler und Unfälle, in: Badke Schaub, P./Hofinger, G./Lauche, K. (Hrsg.): Human Factors: Psychologie sicheren Handelns in Risikobranchen, Heidelberg, p. 36–55.

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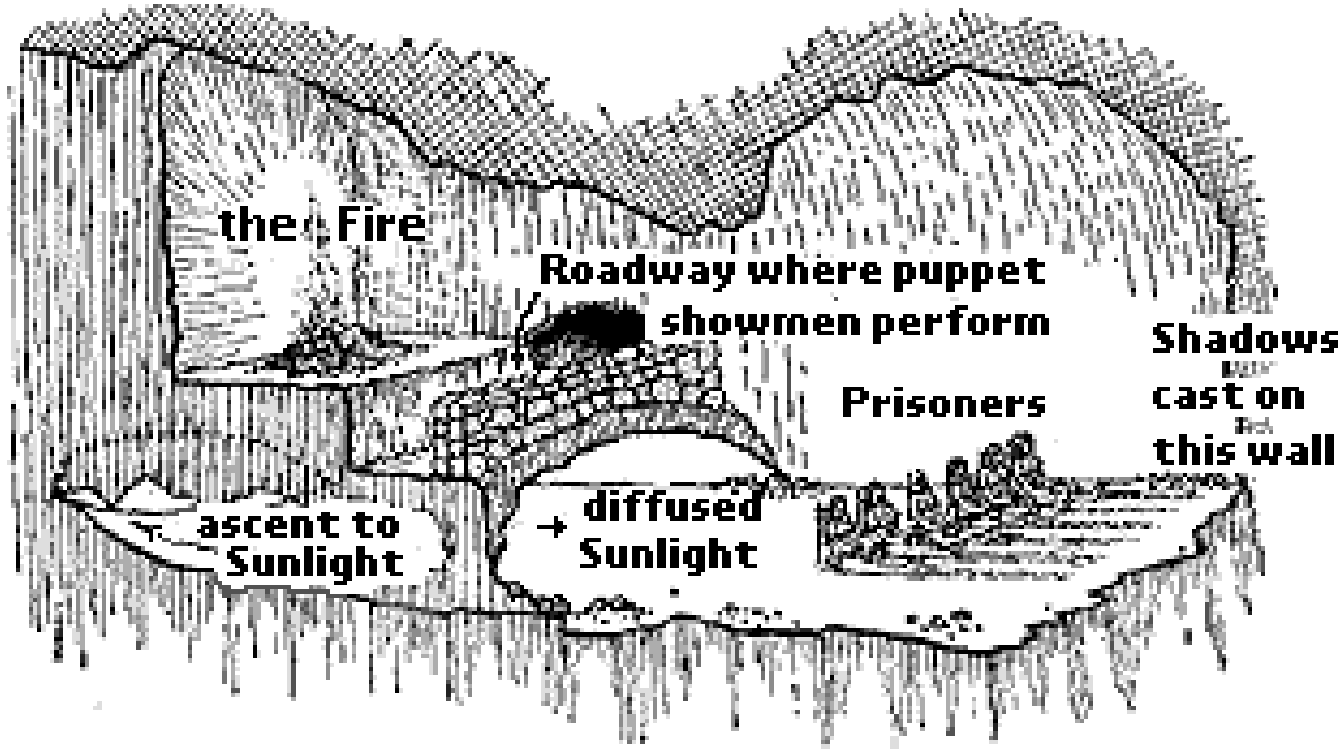
Human beings tend to omit details, since our information processing capacity is limited and strives to be used as effectively as possible.

A Typical Skill-based Error of Omission

Aoccdrnig to rscheearch at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a total mses and you can sitll raed it wouthit porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe.

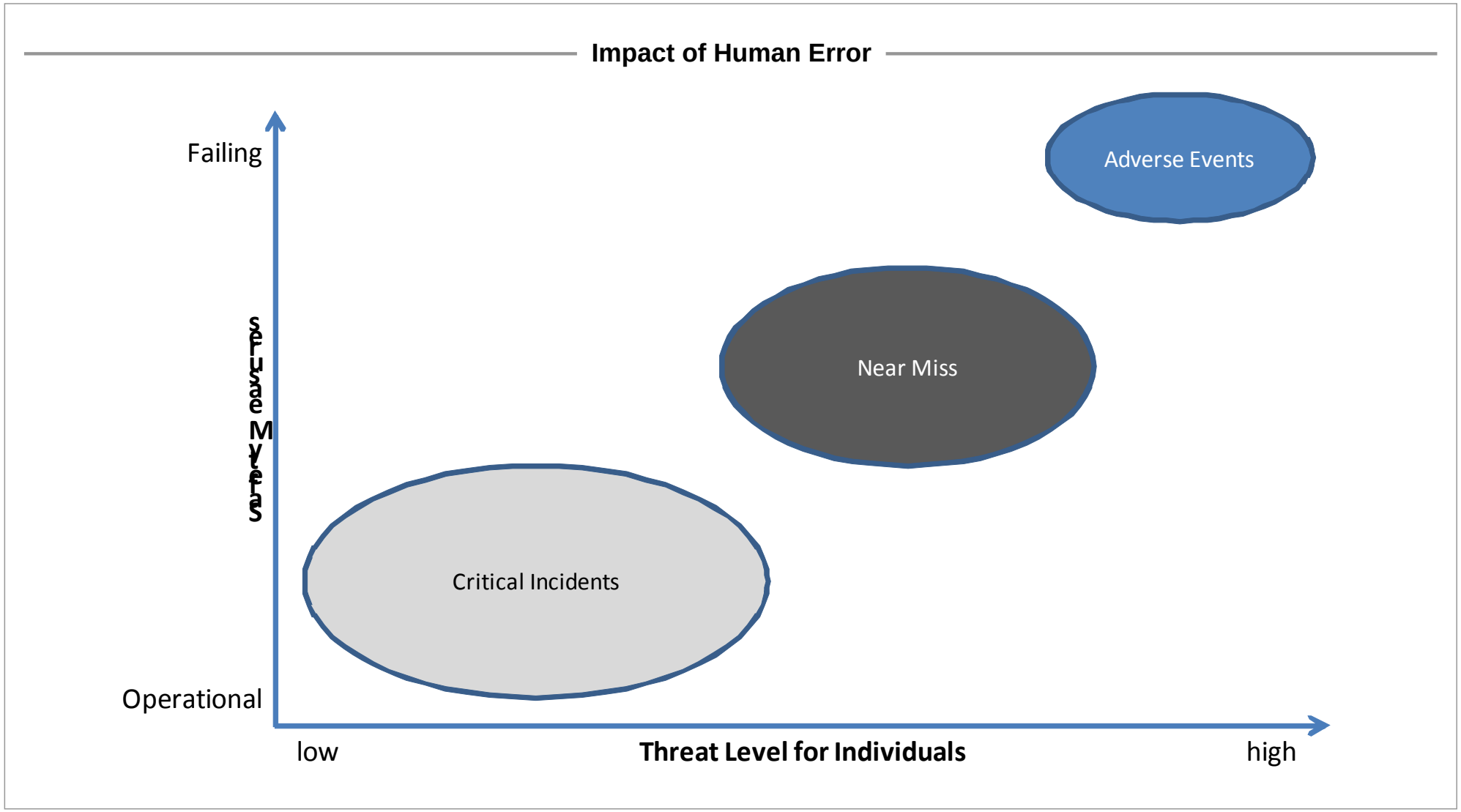
Also our limited capacity to fully understand rationality and reality might be a source of unsafe acts and errors.

A Typical Error of Limited Knowledge: Platon's Cave Analogy



Source: http://faculty.washington.edu/smcohen/320/platoscave.gif

However, not all unsafe acts/ errors necessarily end up in adverse events/ catastrophic disasters.



Source: Adapted from Mistele, P. (2007): Faktoren des verlässlichen Handelns, p. 41.

In the case of the Columbia orbiter, a combination of both physical/technical and human/organizational factors resulted in a catastrophe.

Physical Causes of the Columbia Accident

A 1.7 pound piece of insulating foam **detached** from the left bipod ramp during launch

↓

Detached foam **struck** orbiter's left wing during launch and **created a hole** in the carbon-carbon heat shield

↓

During reentry **superheated air** entered the main wing due to the damaged heat panel

↓

The heated air ultimately **melted** the wing's thin aluminum spar – or structured support

↓

The aerodynamic forces created during this process **disintegrated** the whole orbiter

Columbia Orbiter during Launch

Sources: NASA (www.nasa.org), Columbia Accident Investigation Board (www.caib.us).

The physical cause for the Columbia accident was a damaged tile of the carbon-carbon thermal protection system.

Details of Columbia's Carbon-Carbon Panel Heat Shield

Damaged carbon-carbon panel

Intact carbon-carbon panel

Sources: NASA (www.nasa.org), Columbia Accident Investigation Board (www.caib.us).

The investigation board however also identified several organizational (and thus human) causes for the shuttle catastrophe.

Organizational Causes

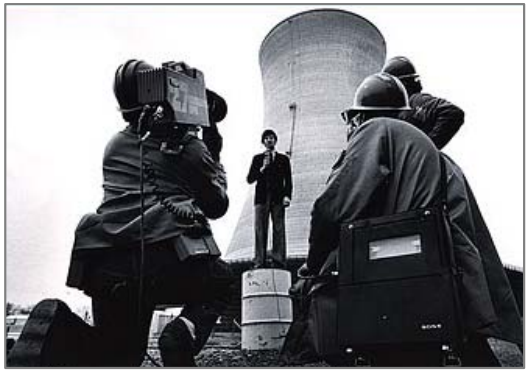
- Failure to classify heat shield damage as a risk (since it had been observed on many orbiters returning safely)
- “Politically” desired flight schedule created flight pressure
- General misinterpretation of shuttle program as an operational system (instead of an developmental project)
- General budget constraints
- Workforce reductions
- Existing organizational practices detrimental to safety, such as
  - Reliance on past success
  - Organizational barriers preventing effective communication
  - Lack of integrated management across program elements
  - Evolved informal chain of command operating outside rules and procedures
- Broken **safety culture**

NASA Mission Control (Johnson Space Center)

Sources: NASA (www.nasa.org), Columbia Accident Investigation Board (www.caib.us).

The reasons for the Challenger orbiter disintegration can be compared to the causes for many other organizational and industrial accidents.

Famous Accidents of the Younger Past



Three Mile Island
(1979)

Herald of Free Enterprise
(1987)

Bhopal
(1984)

Tchernobyl
(1986)

Causes for Accidents

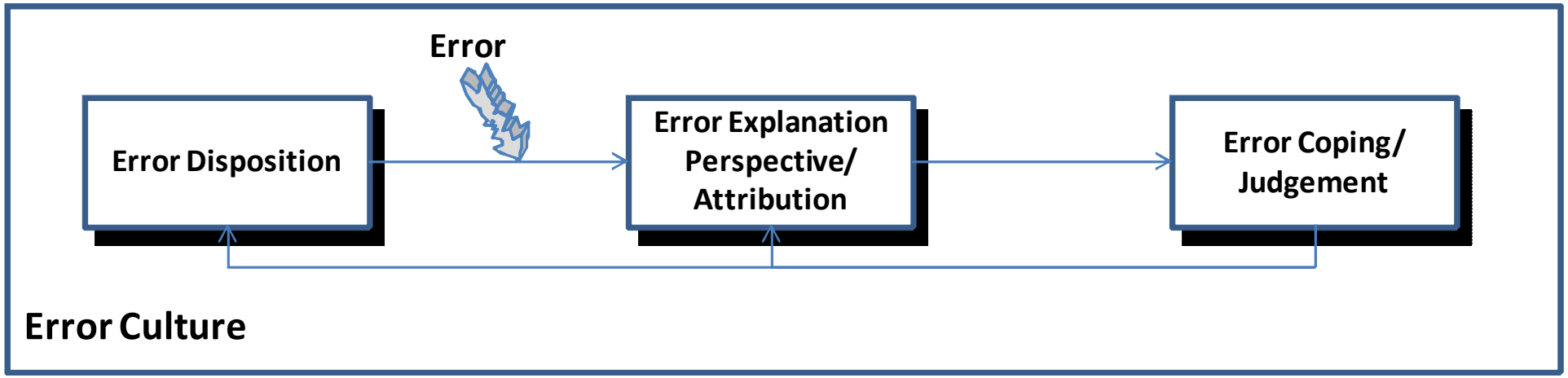
- Latent human failures
- Individual fallibility
- Organisational fallibility
  - managerial failure
  - design failure
  - regulatory failure
  - training failure
  - operational failures
  - Broken error/ safety culture

Error culture is a specific combination of error attribution and error coping/ judgement.

Definition of Error Culture

"The error 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, and organisation's health and safety programmes."

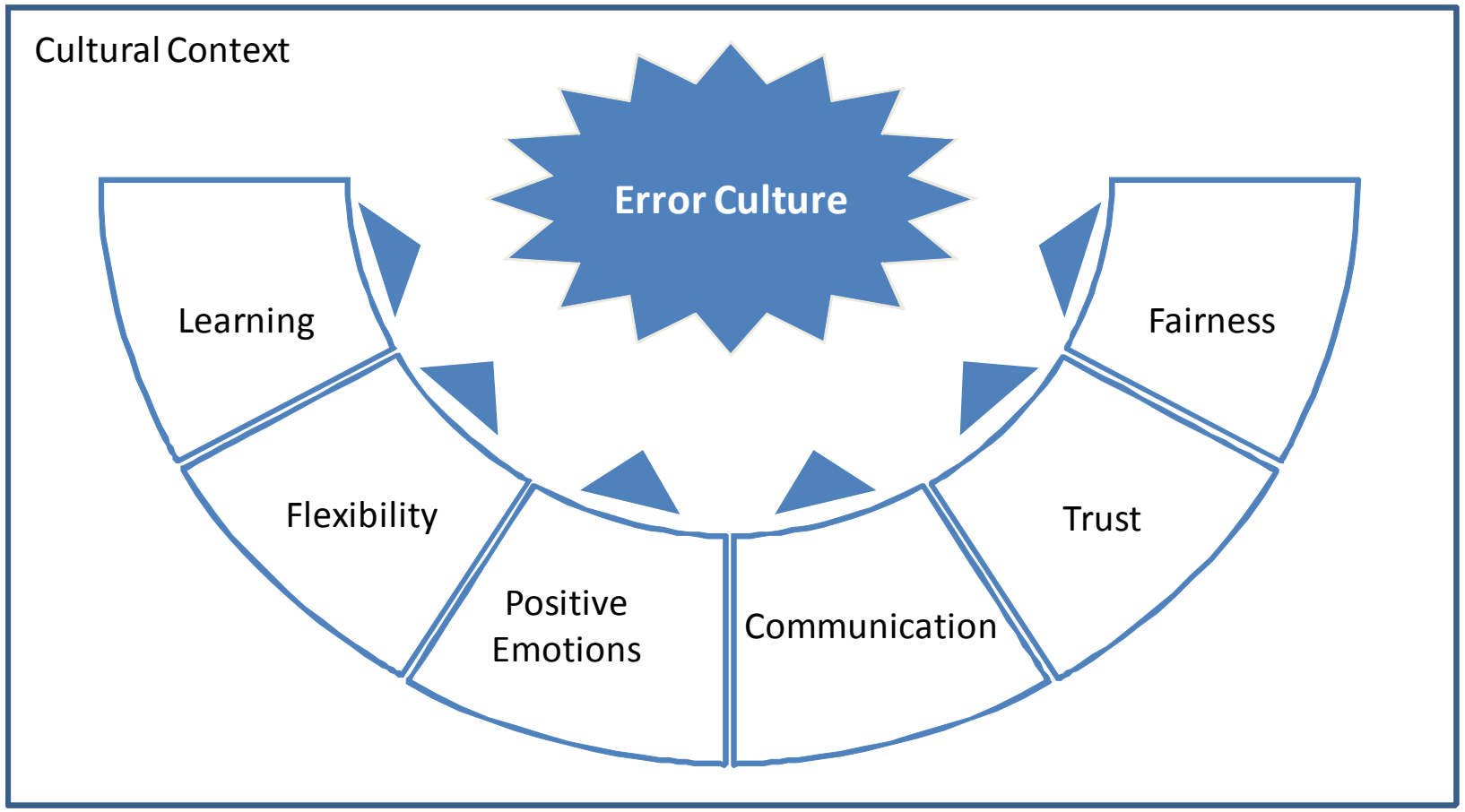
Central Components of an Error Culture



Sources: Adapted from Health and Safety Commission (1993): Third Report: Organizing for Safety, ACSNI Study Group on Human Factors HMSO, London, p. 23.
Own figure

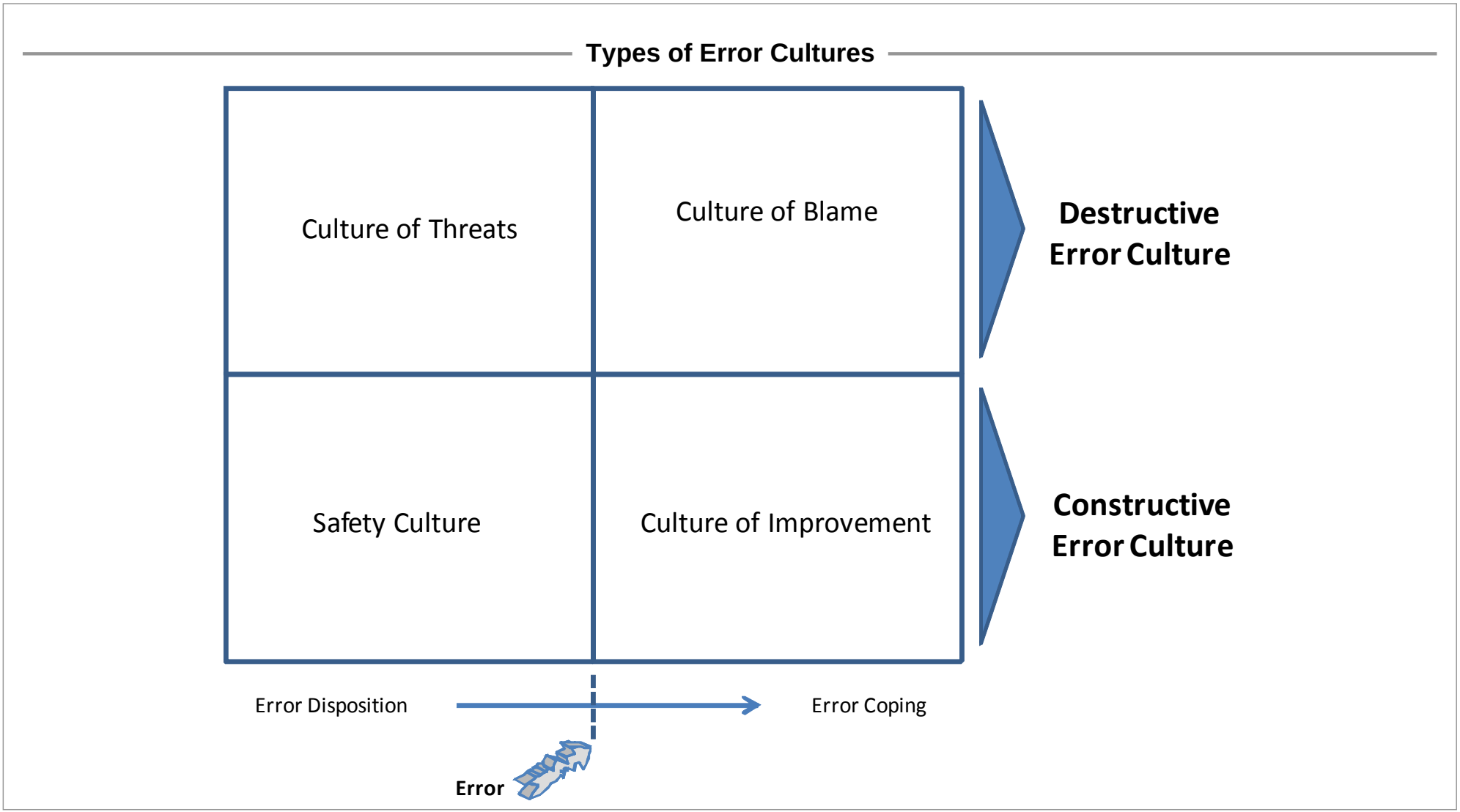
An error culture consists of different dimensions and is embedded in a (meta-) cultural context.

Dimensions of an Error Culture



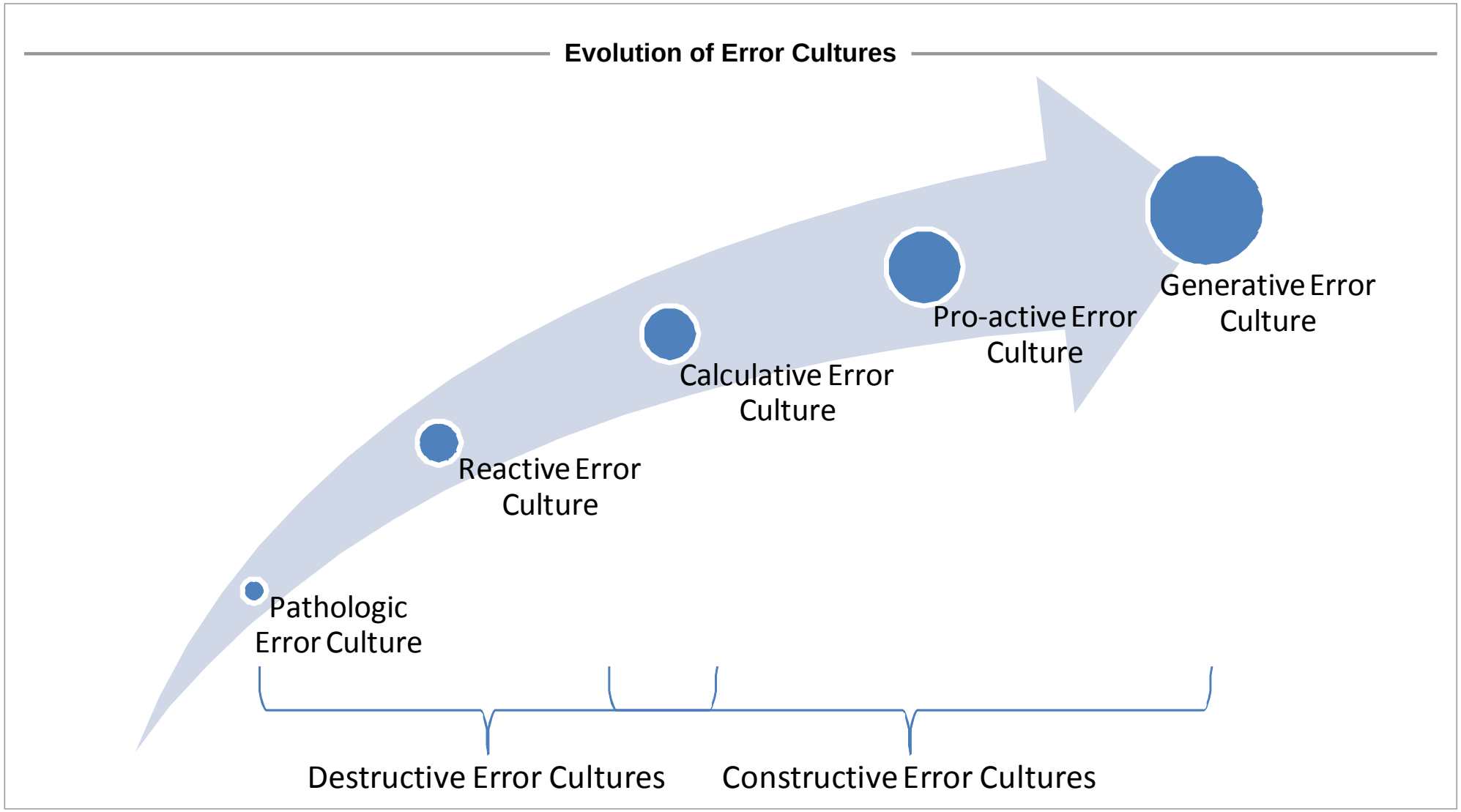
Source: Löber, N. (2009): Sicherheit im Krankenhaus: Eine Frage der Einstellung, in: Arzt und Krankenhaus, Jg. 82, Nr. 11, p. 349.

In general, destructive and constructive error cultures can be distinguished.



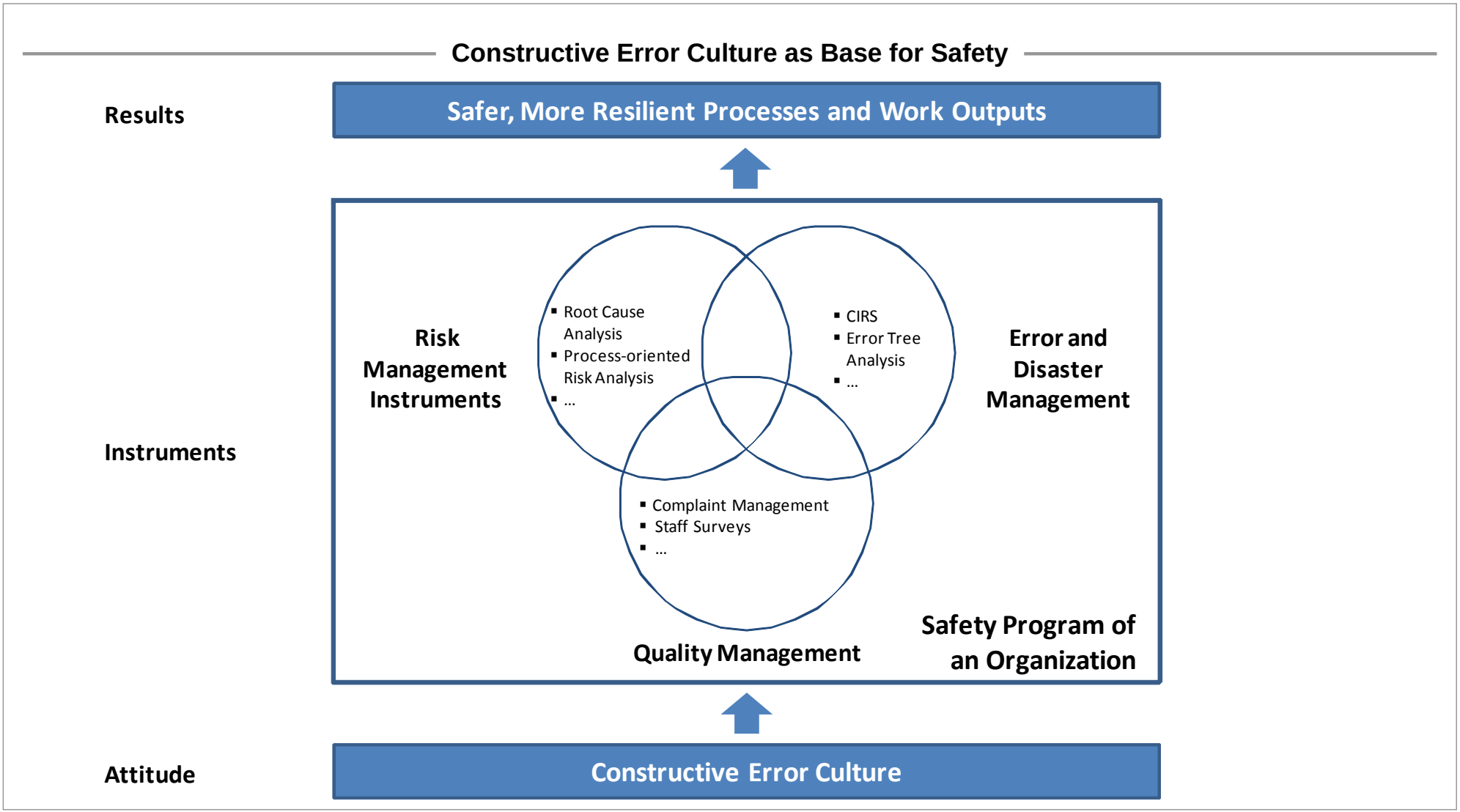
Source: Löber, N. (2011): Fehlerkultur im Krankenhaus, Wiesbaden, p. 232.

Culture is a dynamic phenomenon. Therefore also (error) cultures may undergo a certain development and change process.



Source: Adapted from Hudson, P. (2002): Safety Culture in Industries, p. 11.

Without constructive error attitude, safety instruments will never unfold their full protective potential.

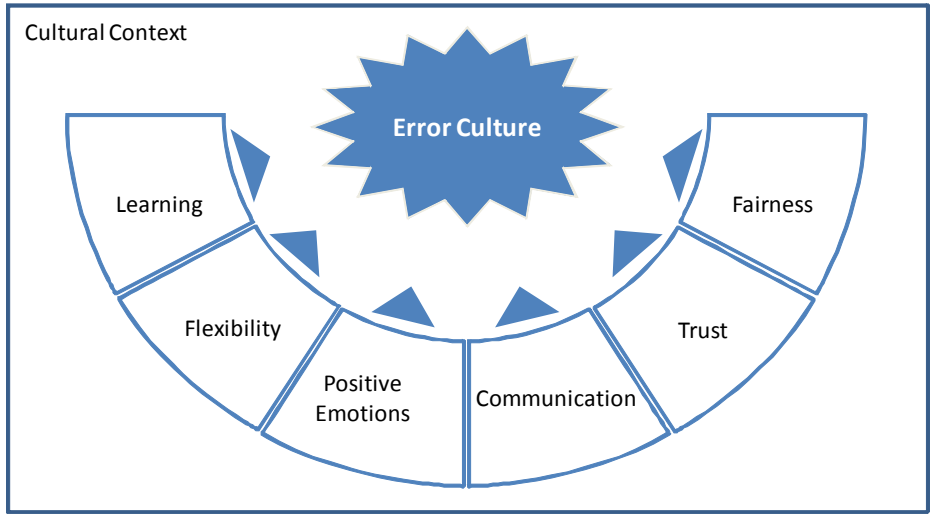


Source: Adapted from Löber, N. (2011): Fehlerkultur im Krankenhaus, Wiesbaden, p. 339.

Depending on the organizational setting and error culture vision, many instruments and actions can be undertaken to improve safety and error culture.

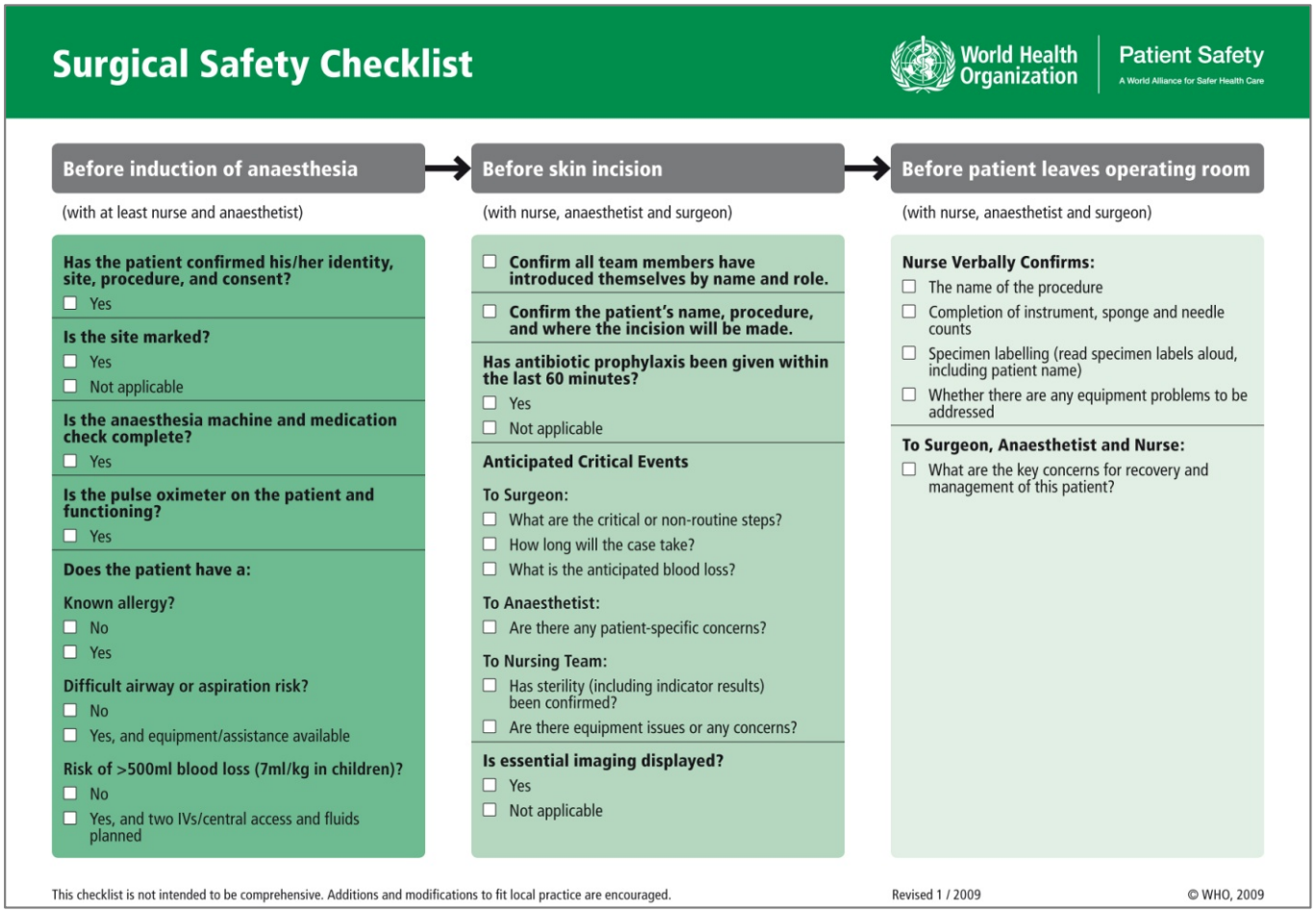
Operational Recommendations for an Effective Error Culture

- Respect human limits and design jobs for safety
- Take advantage of human habits and patterns while designing processes/ workflows (ergonomics)
- Avoid reliance on human memory
- Apply technical (e.g. alarm systems) or procedural (e.g. **checklist** or „time out“) constraints and safeguards (redundancy)
- Train staff for situational awareness/ Increase staff awareness of safety issues
- Include the user/client in the design of safe processes
- Simplify and standardise processes/ workflows whenever possible
- Apply briefings and debriefings where useful
- Improve team work
- Train all staff on al levels for effective communication
- Create an environment where staff freely share information about safety issues without reprisal



Organizational procedures/constraints such as checklists may prevent many errors and accidents from happening.

Example of a Checklist in Surgical Settings



Surgical Safety Checklist

World Health Organization | Patient Safety
A World Alliance for Safer Health Care

Before induction of anaesthesia → **Before skin incision** → **Before patient leaves operating room**

(with at least nurse and anaesthetist)

Has the patient confirmed his/her identity, site, procedure, and consent?
- ☐ Yes

Is the site marked?
- ☐ Yes
- ☐ Not applicable

Is the anaesthesia machine and medication check complete?
- ☐ Yes

Is the pulse oximeter on the patient and functioning?
- ☐ Yes

Does the patient have a:

Known allergy?
- ☐ No
- ☐ Yes

Difficult airway or aspiration risk?
- ☐ No
- ☐ Yes, and equipment/assistance available

Risk of >500ml blood loss (7ml/kg in children)?
- ☐ No
- ☐ Yes, and two IVs/central access and fluids planned

(with nurse, anaesthetist and surgeon)

- ☐ **Confirm all team members have introduced themselves by name and role.**
- ☐ **Confirm the patient's name, procedure, and where the incision will be made.**

Has antibiotic prophylaxis been given within the last 60 minutes?
- ☐ Yes
- ☐ Not applicable

Anticipated Critical Events

To Surgeon:
- ☐ What are the critical or non-routine steps?
- ☐ How long will the case take?
- ☐ What is the anticipated blood loss?

To Anaesthetist:
- ☐ Are there any patient-specific concerns?

To Nursing Team:
- ☐ Has sterility (including indicator results) been confirmed?
- ☐ Are there equipment issues or any concerns?

Is essential imaging displayed?
- ☐ Yes
- ☐ Not applicable

(with nurse, anaesthetist and surgeon)

Nurse Verbally Confirms:
- ☐ The name of the procedure
- ☐ Completion of instrument, sponge and needle counts
- ☐ Specimen labelling (read specimen labels aloud, including patient name)
- ☐ Whether there are any equipment problems to be addressed

To Surgeon, Anaesthetist and Nurse:
- ☐ What are the key concerns for recovery and management of this patient?

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.

Revised 1 / 2009

Source: www.who.org

We cannot change the human condition, but we can change the conditions under which humans work.

Concluding Comments

- Active failures of human beings are **constitutional**
- Human fallibility **cannot** be completely erased by simply changing human behavior
- But: The **conditions**, under which humans work, can be changed

- Unsafe acts/errors have **different impacts** according to the context:
  - In safe contexts errors may even boost innovation and creativity
  - In high reliability contexts errors may put in danger the live of others

- Unsafe acts/errors therefore are **not inherently bad or unwanted**, it depends on the context:
  - Creative, safe environments call for experimental learning and error friendliness
  - High reliability organizations call for collective resilience

- **Changing** the underlying **cultural assumptions** (error culture) seems to be the most fruitful (yet timely) approach to adequately cope with (human) errors in organizational and industrial settings.

Thank you for your attention

Literature Suggestion

Löber, N. (2011): Fehler und Fehlerkultur im Krankenhaus, Gabler Publishing House, Wiesbaden.

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