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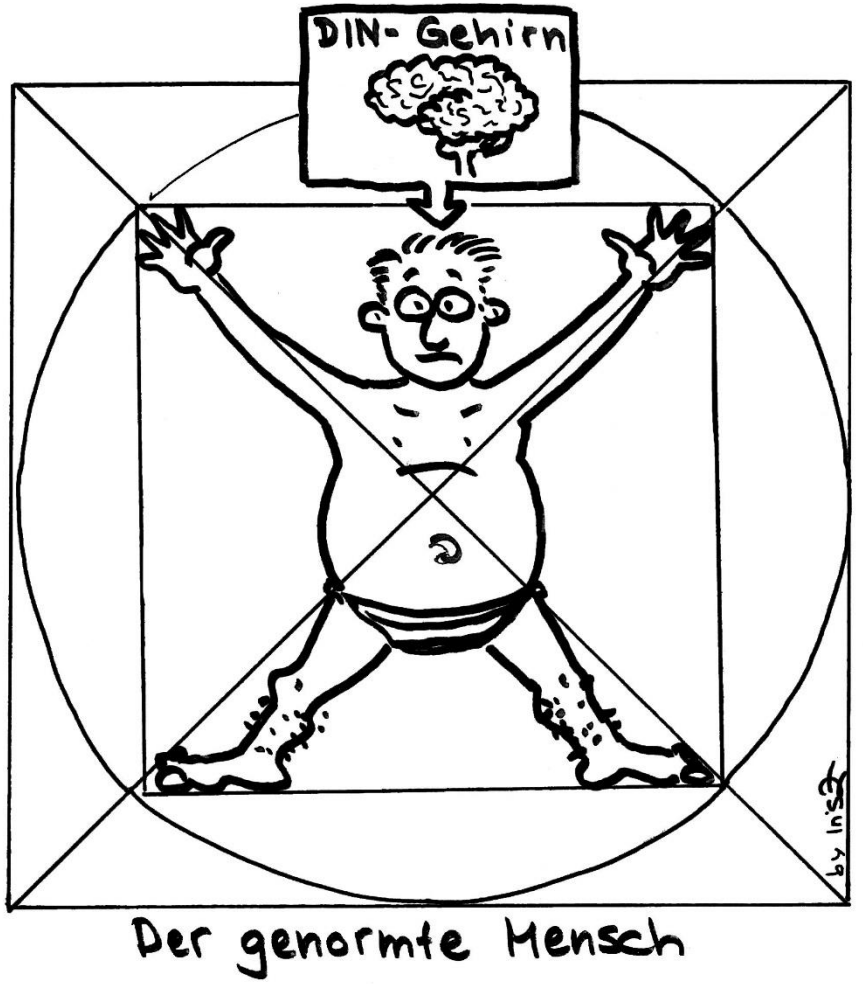
VISION ZERO
Safety.Health.Wellbeing.

Section Machine and System Safety

The human factor: Basics of risk competence

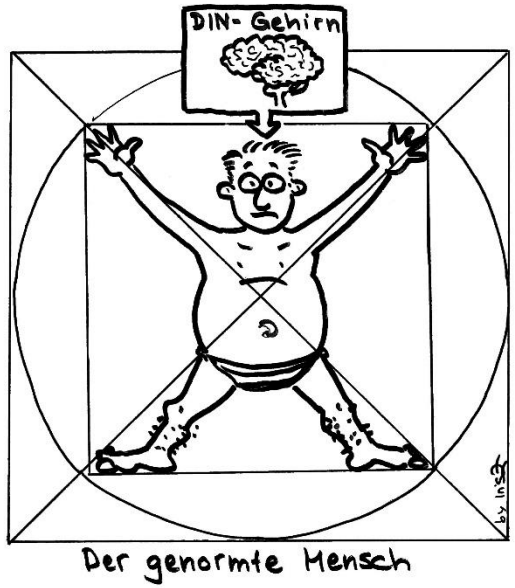
Andrea Weimar, Roma 2023

The human being as a part of the human-machine-system…



What questions need to be asked?

How do we recognize risks and make decisions?



Is it possible to learn risk competence?

What influences the human being?

Which errors are typical?
Errare humanum est…

What is „risk competence“?

… the ability to deal with known and unknown risks of the modern technological world in an informed, critical and reflective manner.


statistical thinking
heuristic thinking
Risc competence
system knowledge
psychological knowledge

Statistical thinking

- **The ability to search for, find, and critically evaluate statistical evidence.**
- **Important: this works only on the basis of known risks!**
- **Thinking in terms of probabilities / statistical terms is very difficult for men!**
- **Particularly difficult:**
  - Distinction between absolute and relative numbers
  - Neglect of the base rate
  - Conditional probability

Example 1: weather forecast

„The probability that it will rain tomorrow is 30% “

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What´s the problem?:

The reference is missing: 30% of what?
The time?
The place?

The association of a single event with a probability without a reference is worthless!

Example 2: health sector

„Contraceptive pills of the „3. generation“ double the risk of thrombosis;
this is an increase of 100%“

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In absolute numbers:

Contraceptives of the 2nd generation: One of 7.000 women had a thrombosis
Contraceptives of the 3rd generation: Two of 7.000 women had a thrombosis

Relative increase: 100%
Absolute increase: 1
But: 13.000 additional pregnancy interruptions, and 800 additional pregnancies of women under 16

Example 3

„ If you live in New York, and you want to drive to Washington by car - how many kilometres would you have to drive to have the same risk of a fatal accident as a non-stop flight? “

Example 3

„ Driving is more dangerous than flying – let's say you live in New York, and you want to drive to Washington – how many kilometres would you have to drive to have the same risk of a fatal accident as a non-stop flight“

…after 20 kilometres!
(distance New York – Washington: 328 km)

„Fact boxes“, Prof. Gigerenzer, Harding-Center for Risk Compentence

- Using absolute numbers instead of relative numbers
- **Much easier for risk communication!**

Heuristic thinking

- Strategy to deal with unknown risks which cannot be calculated
  - ► necessary when making decisions under uncertainty
  - ► shortened cognitive operations.
- A heuristic is a rule that focuses on the essentials and ignores the rest.
- Does the human know that there´s a risk?
- With unknown risks, good decisions also require intuition and clever rules of thumb.
- Heuristics can be useful, but also obstructive.

Heuristic thinking

"Trust your doctor!

"Hire good people and let them do their job."

"Spread the risk"

"That's what we've always done here (...then it'll be right too)"

Typical biases

- **Availability heuristic**
  - Events that are particularly easy to recall (= available) in a person's memory are overestimated in frequency. For example, paramedics overestimate the probability of accidents

- **Halo effect**
  - Certain positive characteristics of a person are inadmissibly inferred from others, they "outshine" (= halo) the person: we think that someone who is good-looking is also more intelligent and more successful.

- **Anchoring bias**
  - On the basis of a single stimulus, all further stimuli are classified. I.e., individual deaths in a crisis region are perceived as less serious if there have previously been attacks with many deaths.

System knowledge

- **Knowledge of the function or disfunction of a specific system, such as health or banking system.**

- **Knowledge of structural dynamics, conflicts of goals and interests of the various actors and the associated strategies, like**
  - defensive decision-making
  - misleading information
  - suggestion

Psychological knowledge

- **Knowledge of human factors that influence risk-taking behaviour e. g.**
  - individual characteristics (risk-seeking / risk-aversive)
  - shock risks: trigger fear and avoidance behaviour
  - systematic underestimation of certain risks
  - social learning

- **Mental framework**
  - attention
  - information processing
  - physiological conditions
  - emotions

Man or machine – who is more clever?

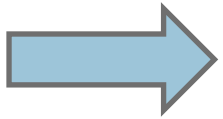
- Thinking errors and cognitive distortions make us pessimistic
- At the same time: the cerebral equipment, flexibility, adaptability is an advantage!

Conclusions for working systems

- Error friendly design of working systems
- Ensure fallback levels in safety relevant systems
- Reflect always routines! Every time!

Conclusions for woking systems-2-

- Most important: the social factor (the working team)
- Good communication
- Good leadership



“Psychological Safety”, Amy Edmondson

Psychological Safety

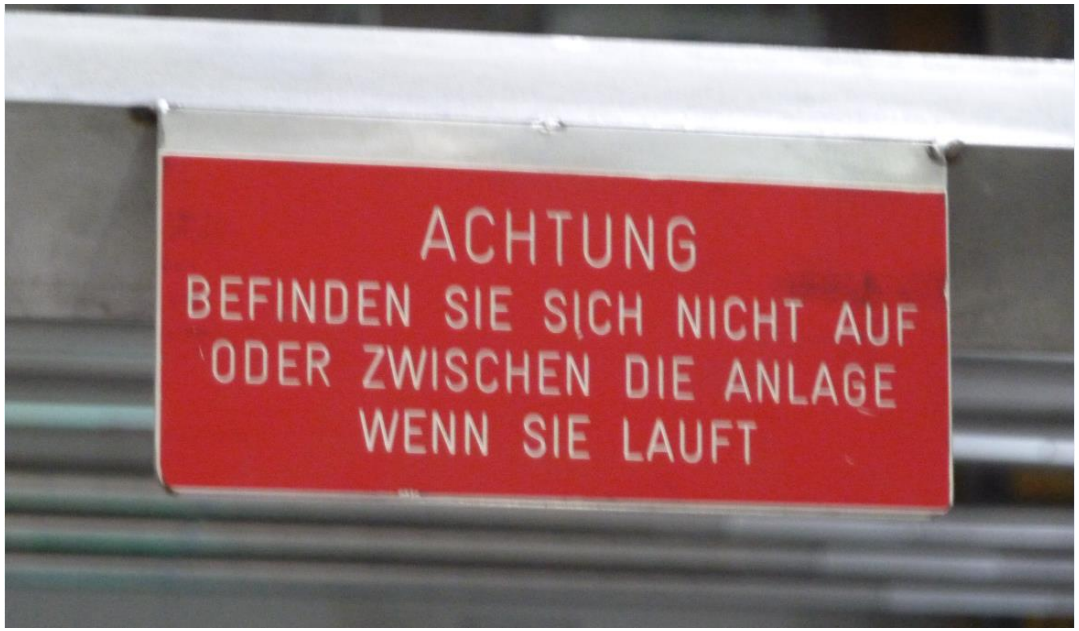
- … describes an atmosphere, where people feel safe enough to take interpersonal risks and to speak up about their concerns, questions or ideas
- If colleagues don´t talk about their concerns and thoughts, it is dangerous for the work system and the organisation, because the ability of growth and innovation in the company is inhibited
- Executives play a central role

Psychological safety and performance

	low standards	high standards
high psychological safety	zone of comfort	zone of learning and high performance
low psychological safety	zone of apathy	zone of fear

Conclusions for working systems – 3 -

- Crucial: good communication and information about risks



A foreseeable case of error…

What is necessary?

- Use clear and easy communication: information and communication have to fit to humans!
- Consider language barriers
- Consider the cultural background
- Qualification and lifelong learning is necessary!

Literature

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Grazie per l’attenzione!