

# Uncertainties due to human factors; and how to deal with them

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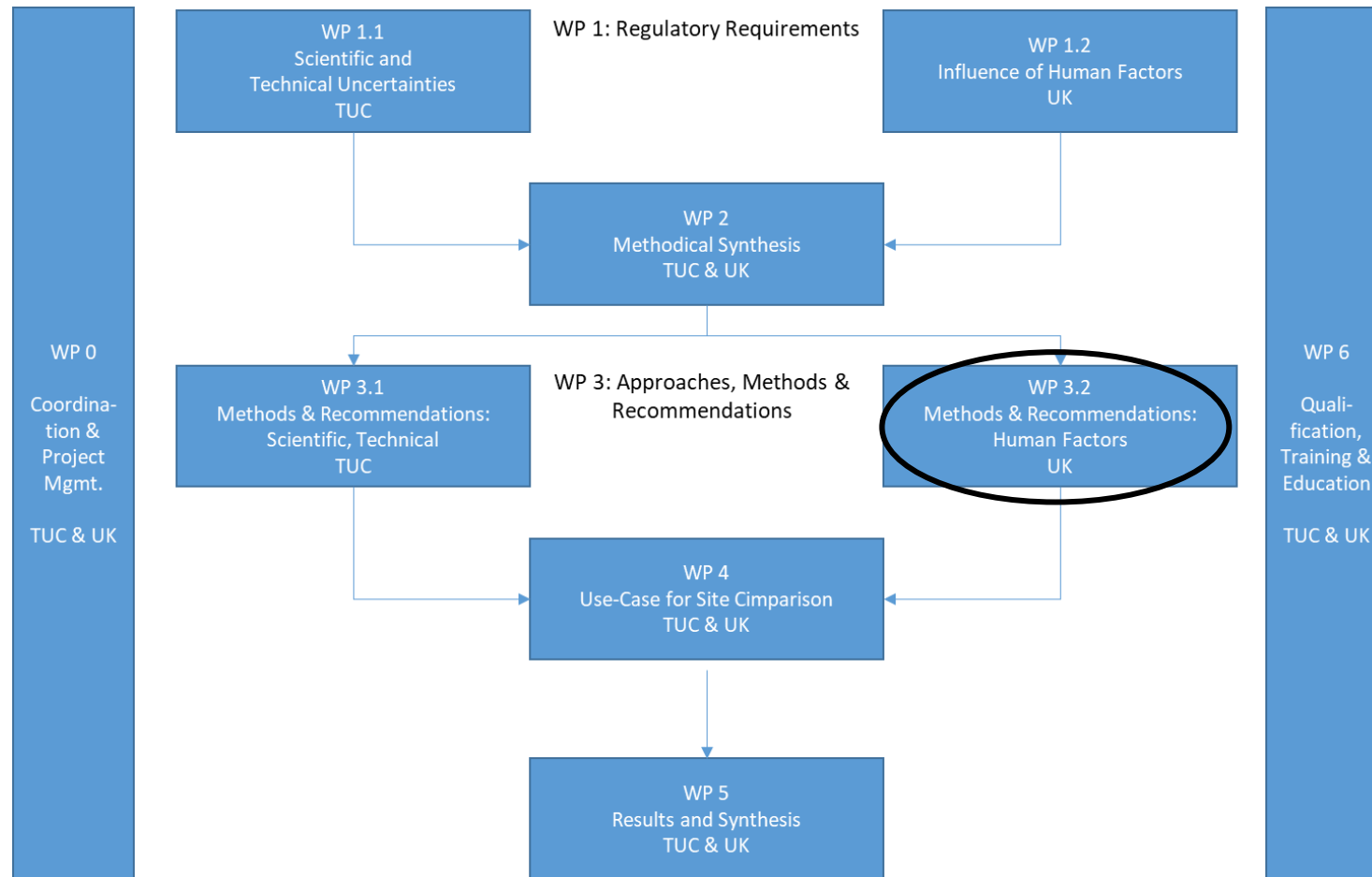
- 1) ENSURE: general information and goals
- 2) Overview of uncertainties due to human factors
- 3) Our attitude on how to deal with them
- 4) Our method (AHRIC) and recommendations
- 5) AHRIC – Result evaluation
- 6) Current/Next steps in ENSURE

# ENSURE: general information and goals



- „**En**dlagersicherheit: **U**ngewissheiten und **Reg**ulatorische Aspekte“ („Repository Safety: Regulatory Aspects of Uncertainty and Robustness“)
- UK
  - Analysis of possible influences of psychological aspects on the assessment process
  - Making assessment processes more robust
  - Derive holistic approaches and methodologies for the consideration of human factor uncertainties
- TUC
  - Literature review: Uncertainty management in national and international regulations and recommendations
  - Development of guidelines for uncertainty management
- Use case: Uncertainty management during site comparison

# ENSURE: general information and goals



## Cognition - Human information processing

- Based on cognitive concepts (developed through individual experiences) (Neisser, 1979; Sträter, 2012)
- Has limits regarding perception, processing
  - Perception, e.g. Interest and dissonance (reduction) (Festinger, 1957)
  - Processing, e.g. short-term memory (Miller, 1956)
- Leads to the use of simplifications and heuristics (mental shortcuts)
  - Devaluation of conflicting information
  - Practical search for solutions with the risk of biases



# Overview of uncertainties due to human factors

## Human behavior

- ...As a result of human information processing
- Observable (body movement of a person)
- Observable in ourselves through “looking inside” (introspection)
- Can be shaped by consequences, e.g. positively reinforced (Holland & Skinner, 1974)



[2]



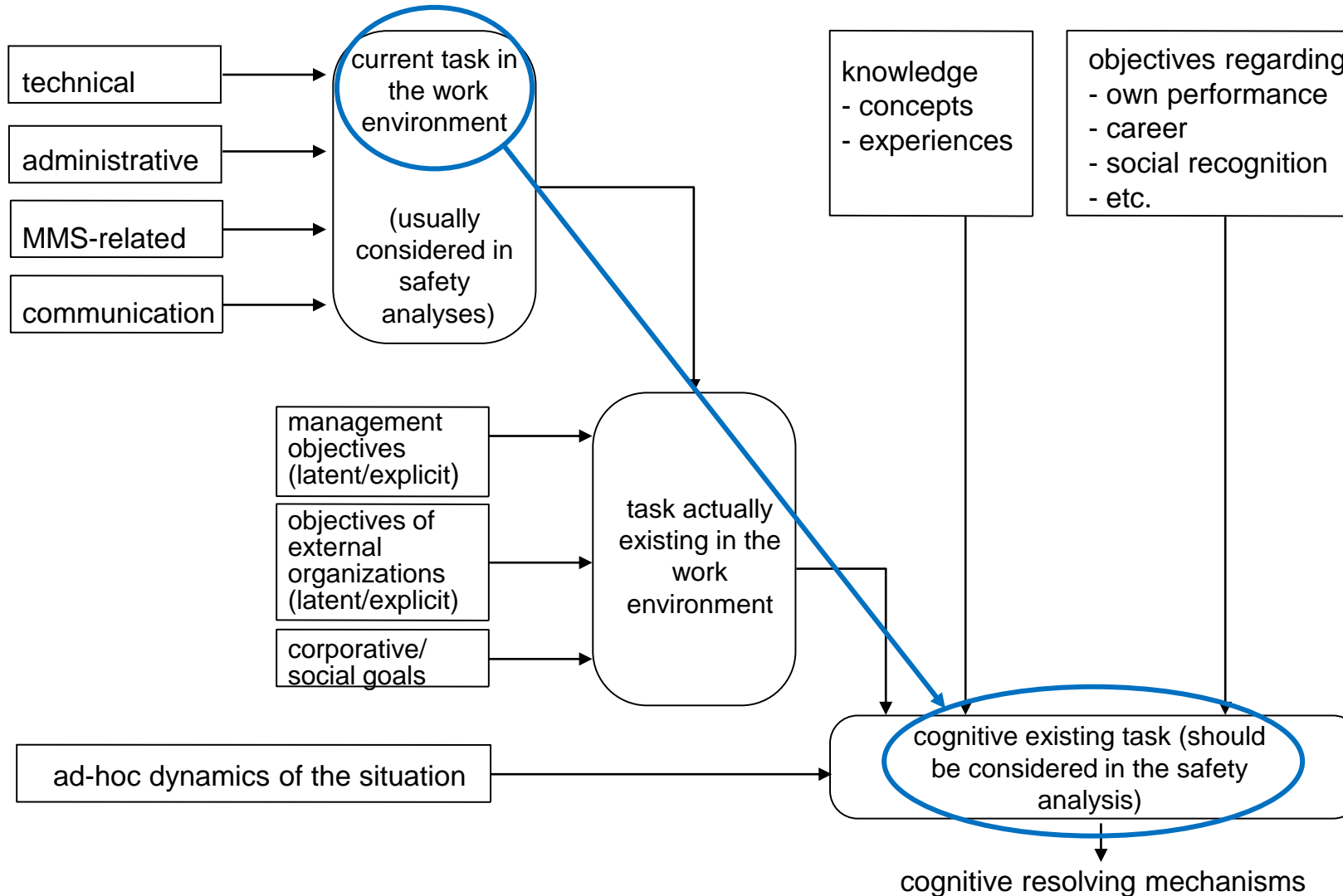
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# Overview of uncertainties due to human factors

## Influences of the situation on human behavior



(VDI 4006 Blatt 2, 2017)

# Our attitude on how to deal with them

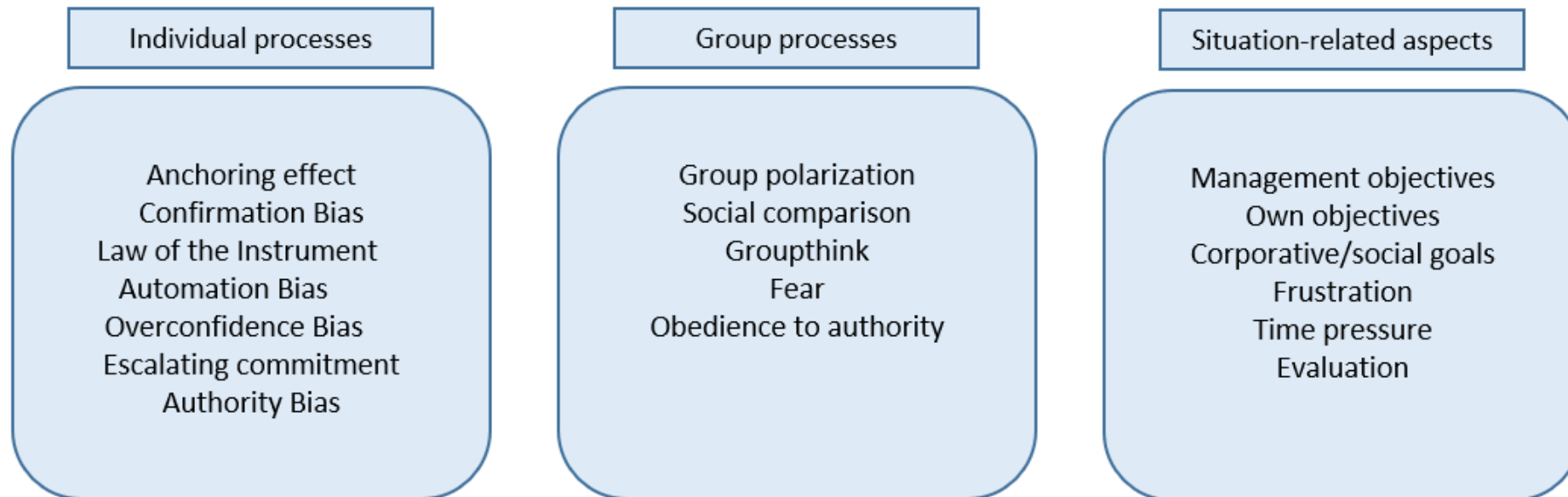


- Uncertainties due to human factors
- No search for errors / no finger pointing
  
- Goal: Development of an assessment tool (questionnaire) to measure and improve human reliability
  - with recommendations / action steps to increase human reliability
  - to develop a self-questioning attitude
  - to increase confidence in one's own work



# Our method (AHRIC) and recommendations

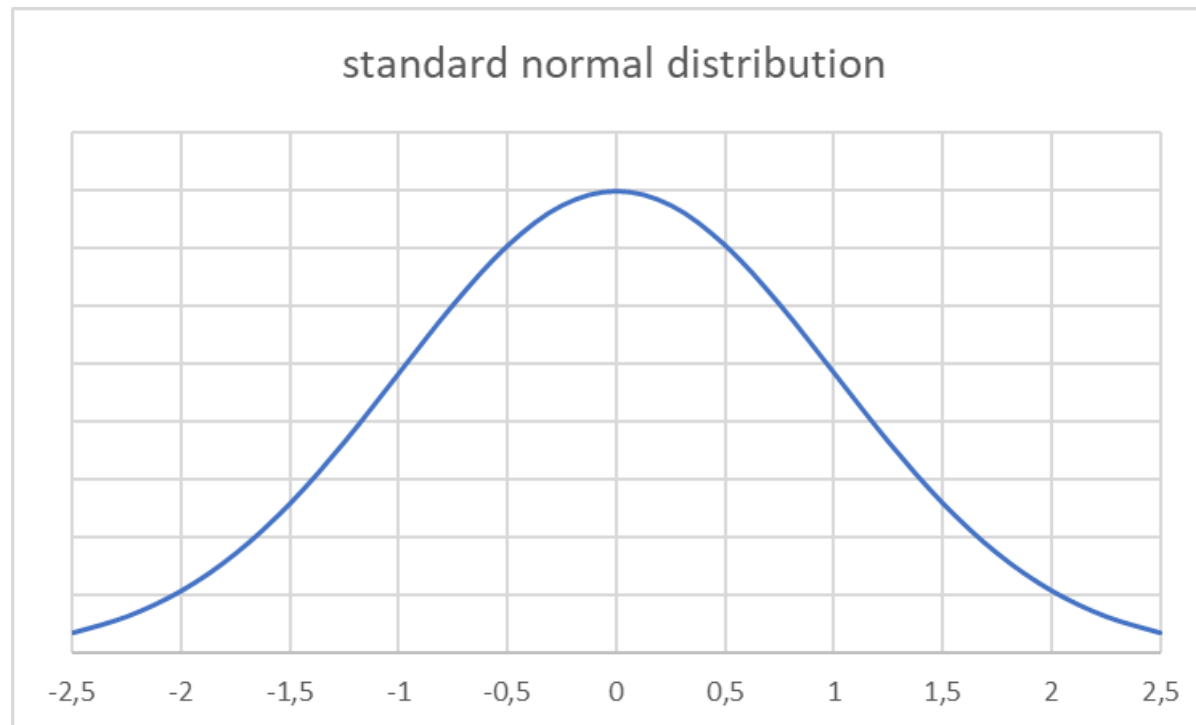
- **A**ssessment of **H**uman **R**eliability **I**n **C**oncept phases
- Self-rating statements as self-monitoring
- 23 human factors with 103 items (current version)
- Application: Evaluation of own processes in the context of final disposal of radioactive waste or site selection



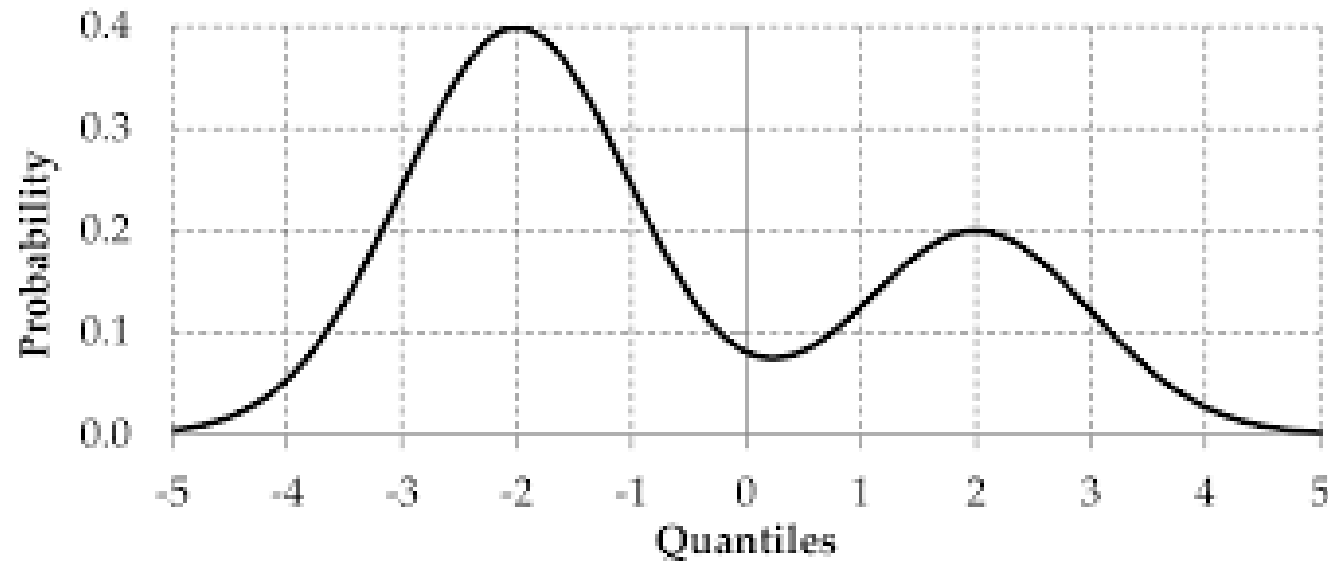
# AHRIC – Result evaluation



- Goal: normal distribution for all items

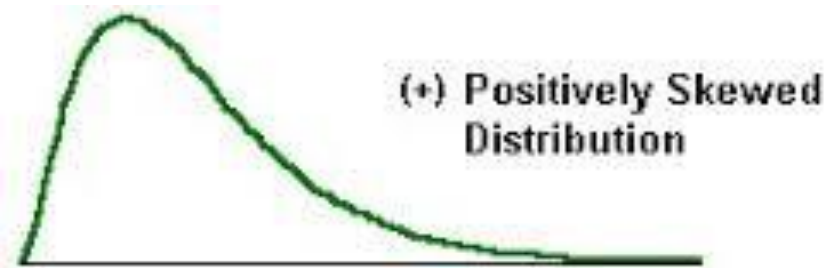


- Bimodal distribution → item measures two different aspects



[5]

- Insufficient differentiation between values
- Missing requirement for statistical tests



(-) Negatively Skewed Distribution



[6]

# Current/next steps in ENSURE

- Development of a reference database (we need more data)
- Development steps based on item analyses and content-related arguments (reduction of items)
  - E.g. social desirability items
- Formulation of automated recommendations for action

# Thank you for your attention



**BUNDESGESELLSCHAFT  
FÜR ENDLAGERUNG**



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[2]: <https://www.nordsee-zeitung.de/Norderlesen/Die-Titanic-war-ihr-Schicksal-55840.html>

[3]: <https://www.swr.de/swrkultur/wissen/archivradio/massenpanik-21-tote-bei-loveparade-in-duisburg-2010-100.html>

[4]: <https://reisetopia.de/news/boeing-rueckgang-flugzeug-auslieferungen/>

[5]: <https://www.mdpi.com/1099-4300/22/5/545>

[6]: [https://www.mbaskool.com/business-concepts/statistics/8409-positive-skewness.html#google\\_vignette](https://www.mbaskool.com/business-concepts/statistics/8409-positive-skewness.html#google_vignette)