

Technological Projects Free of Failure

Technische Projekte, die keine Fehler zulassen

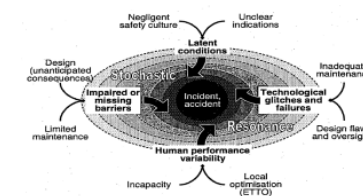
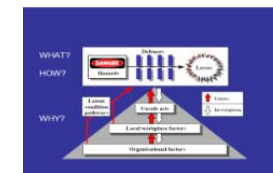
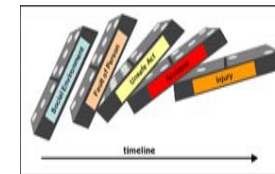
Prof. Dr. habil Oliver Sträter

University of Kassel
Faculty of Mechanical Engineering
Human Engineering & Organisational Psychology
straeter@uni-kassel.de
+49 561 804 4211

ENTRIA Workshop on “Technological Monitoring and Long-Term Governance”
(Karlsruhe)

o Impulse & Discussions

- Human Error and performance
- Organization / System / Society
- Nature of Human Decisions and Actions
- Time and Dynamics



Human Behavior ...



Error

emotionally negative

Performance

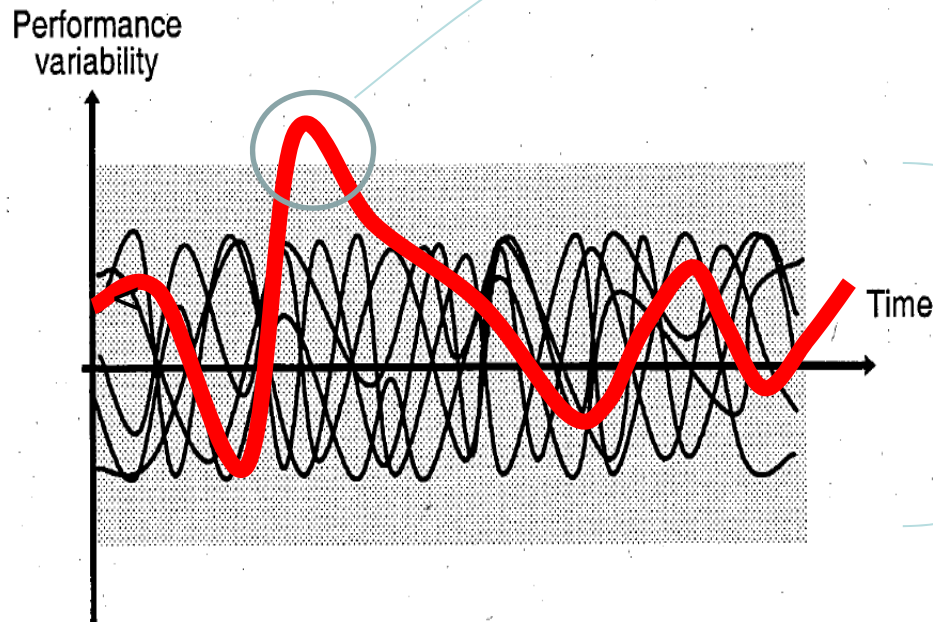
emotionally positive

... two sides of the same behaviour

and ... the hindsight-bias

How could you forget to think of...

Great that you considered this ...



Robustness:

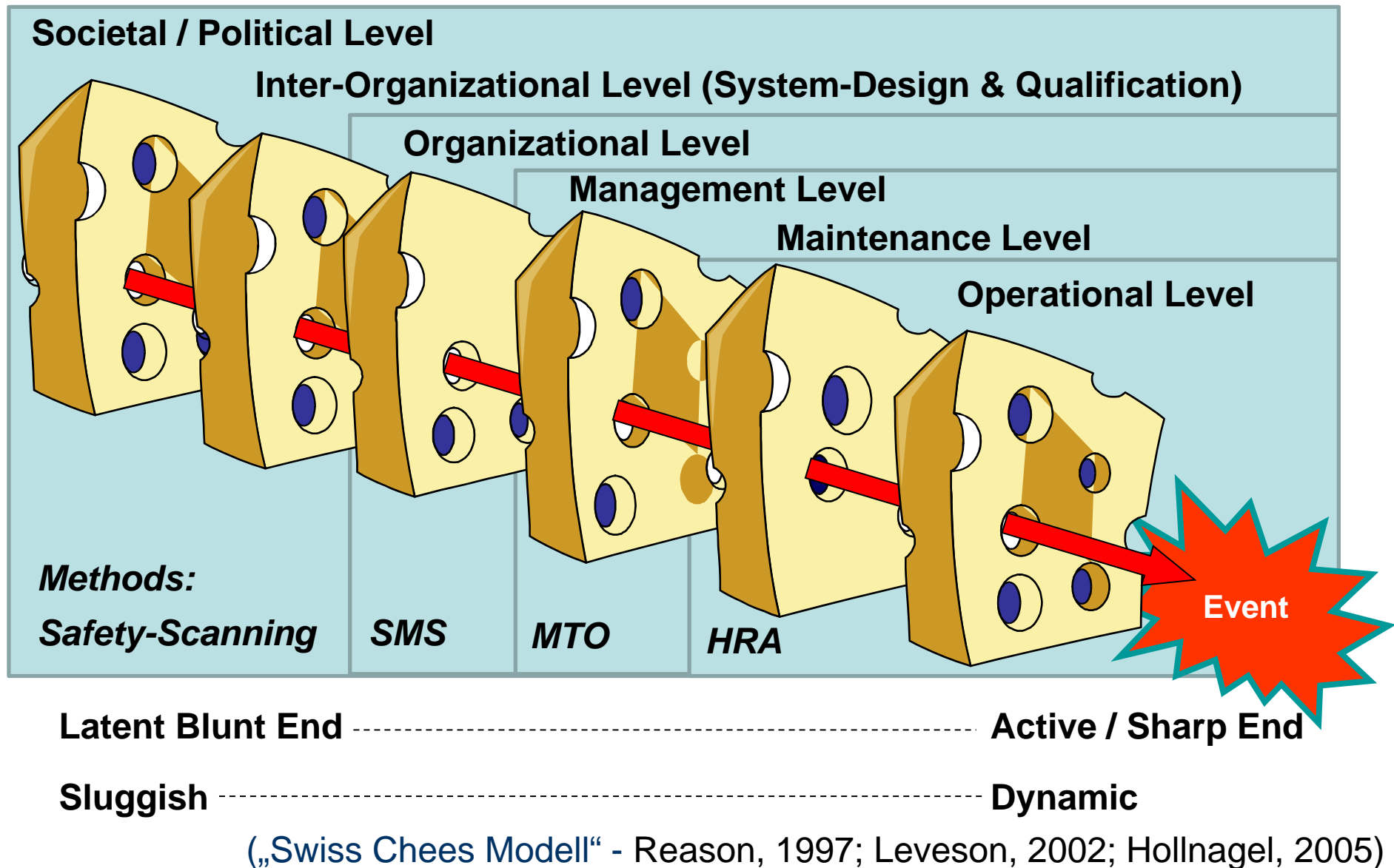
- Minimizing the deviances exceeding the band of tolerance
- Error-oriented view

Resilience:

- Deviances show positive properties of the system to act in a flexible way
- Understanding of the deviances leads to better design of the system-properties to meet deviances

Anti-Fragility / Flexibility:

- Deviances are signs and opportunities of system-development
- The earlier the better



Example Political Level

Today's Cost Decision for a final disposal

Derzeit wird in einer weiteren Kommission darüber gestritten, wie ein Endlagerstandort gefunden werden soll. Der Staat sucht, baut und betreibt das Endlager und nimmt den Konzernen die Verantwortung für die Zwischenlager ab, sobald die Reaktoren zurückgebaut worden sind.

...

Da das Verursacherprinzip beibehalten werden soll, sollen die Konzerne darüber hinaus 17,2 Milliarden Euro aus ihren Rückstellungen und zusätzlich 6,14 Milliarden Euro als Risikoaufschlag in einen neuen öffentlich-rechtlichen Fonds einzahlen. Mit dem Risikoaufschlag soll die Lücke gedeckt werden, die wegen der erwarteten niedrigeren Zinsen angenommen wird. Zudem rechnet die KFK mit einer zwei prozentigen jährlichen Kostensteigerung für Rückbau und Lagerung des Atommülls über die Inflationsrate hinaus, sagte der KFK-Vorsitzende Jürgen Trittin dem Tagesspiegel.

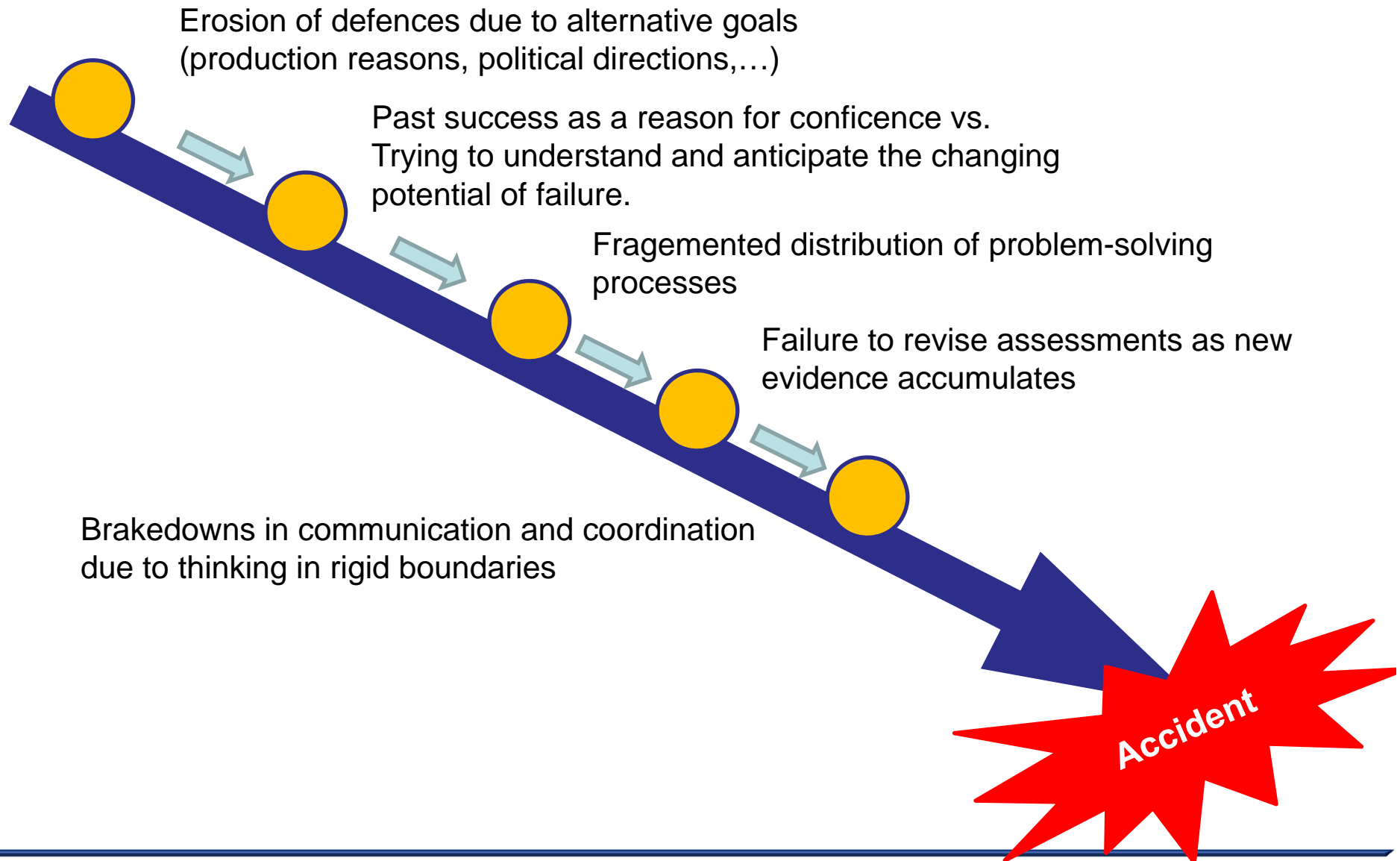
<http://www.tagesspiegel.de/politik/vorschlag-der-kernenergie-kommission-so-viel-kostet-der-atomausstieg/13511748.html>

Mental shortcuts that provide fast assessments of appropriate behaviour and are difficult to revise though new evidence occurs

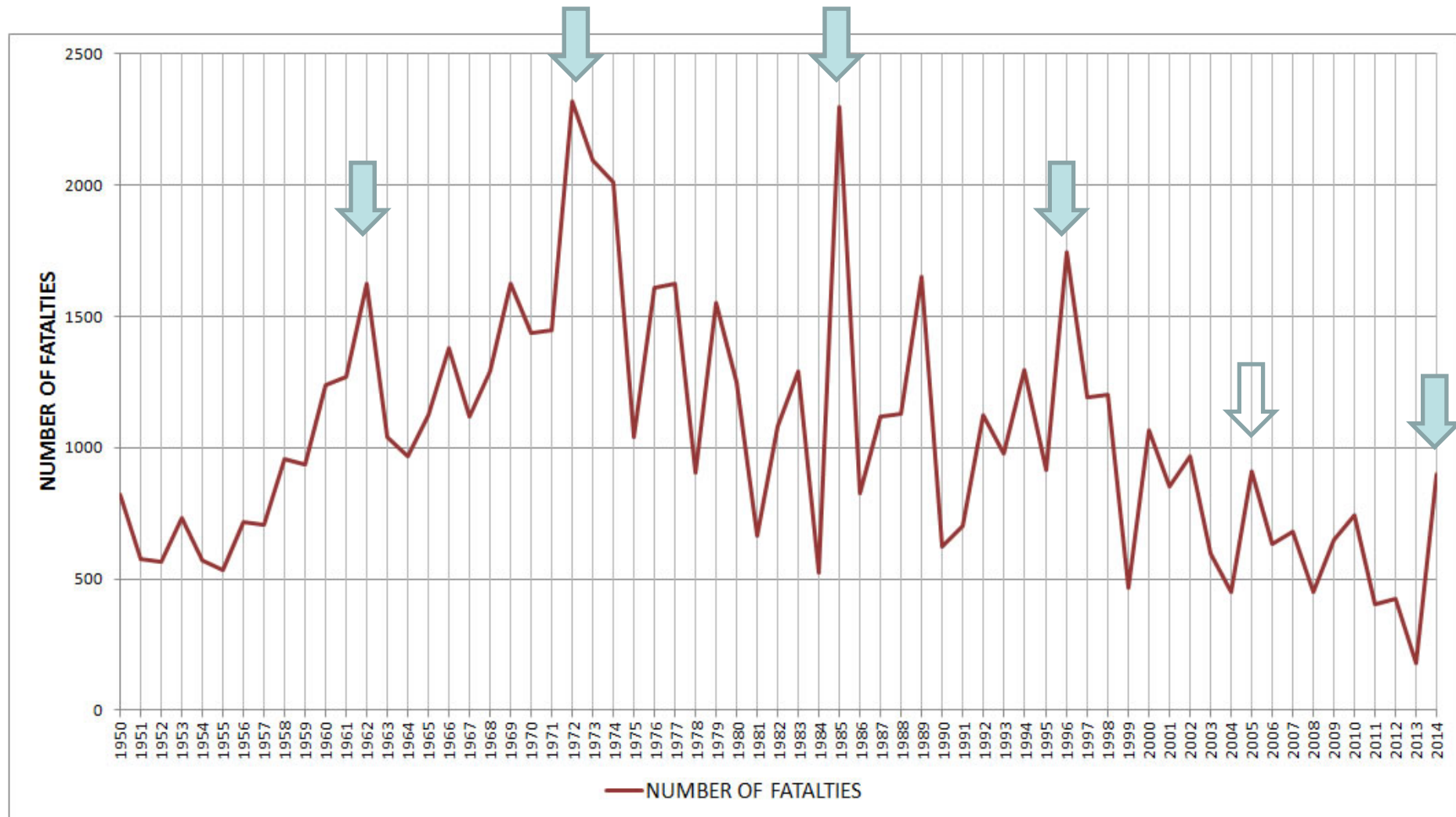
- Representativeness
- Availability
- Frequency Gambling
- Similarity matching
- Anchoring



„Drift into Failure“ concept (David Woods)



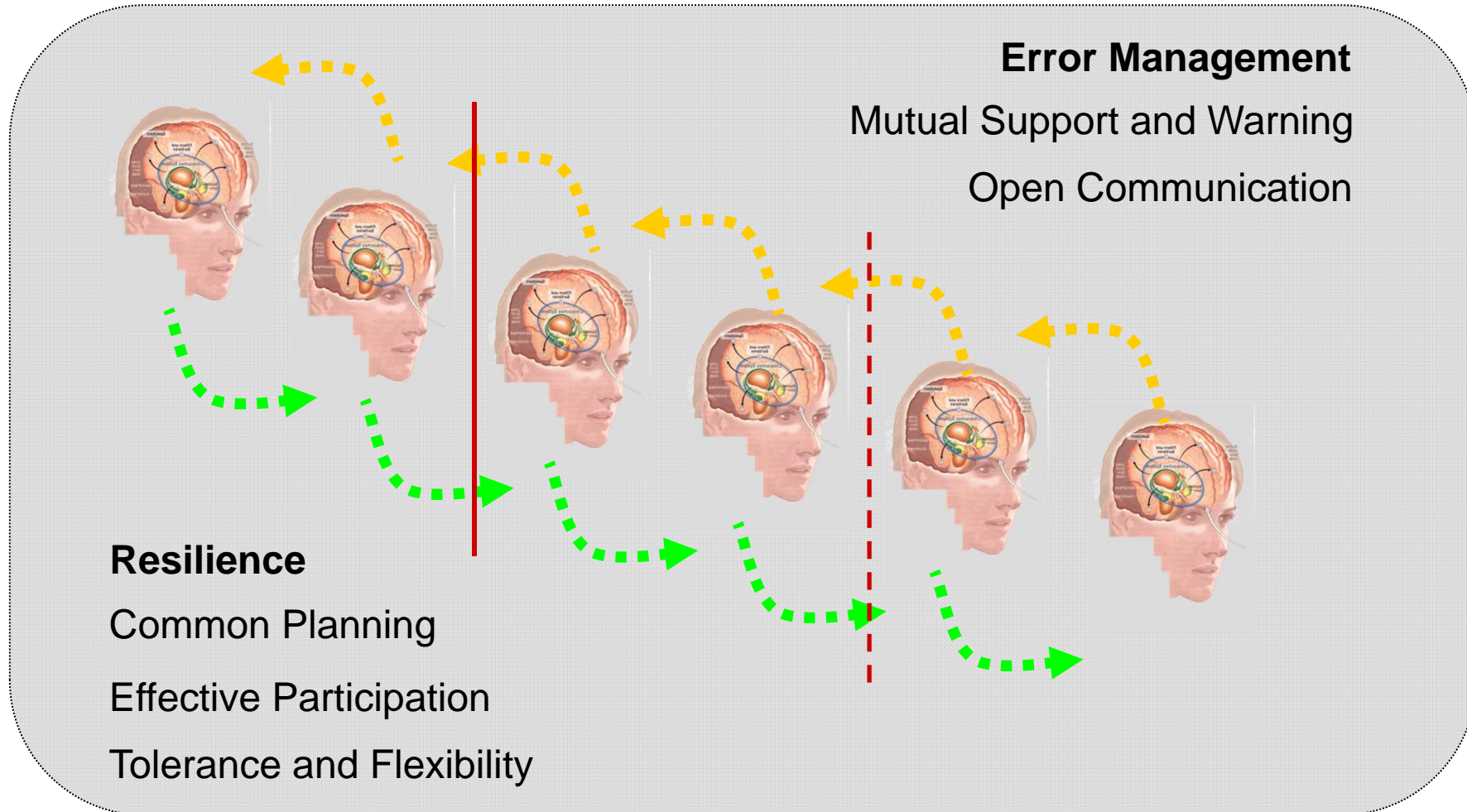
Dynamics of Unwanted Events (Example Aviation)



10 years rhythm result of educational system not of technical domain

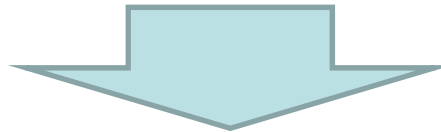
Safety Culture

Shared Attitudes on all levels on



– Properties of Human Behaviour

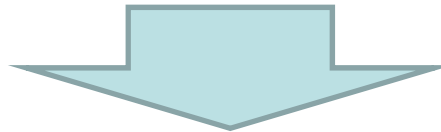
1. Will the nature of human behaviour change in the time-frame relevant for a disposal site ?
2. Will any current safety-design be able to foresee all the safety relevant aspects of a disposal site for the time-frame relevant ?



1. No
2. No

– Organization / System / Society

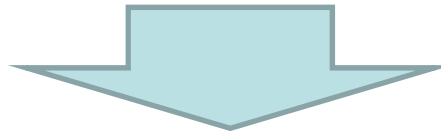
1. Will an Organization be able to manage a disposal site with a sufficient safety-level ?
2. Will the governance context of a disposal site be able to support this organization sufficiently ?



1. Yes, if nature of human behavior will be considered in the principles of the organizational structures and processes
2. Yes, if the governance structures develop a sustainable view and a support attitude towards disposal site (proactive & supportive regulation)

– Nature of Human Decision Making

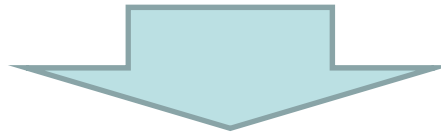
1. Will a design process be able to foresee allocate a suitable safety-design for a disposal site ?
2. Will a design process be robust / resilient / anti-fragile ?



1. Only if an adequate process is ensuring the safe management of heuristics
2. Only if disposal is recognized as a long term societal task

– Dynamics

1. **Will an Organization be able to maintain high safety levels for a disposal site over the time span ?**
2. **Will an Organization be able to adequately react on new developments in technology or society ?**



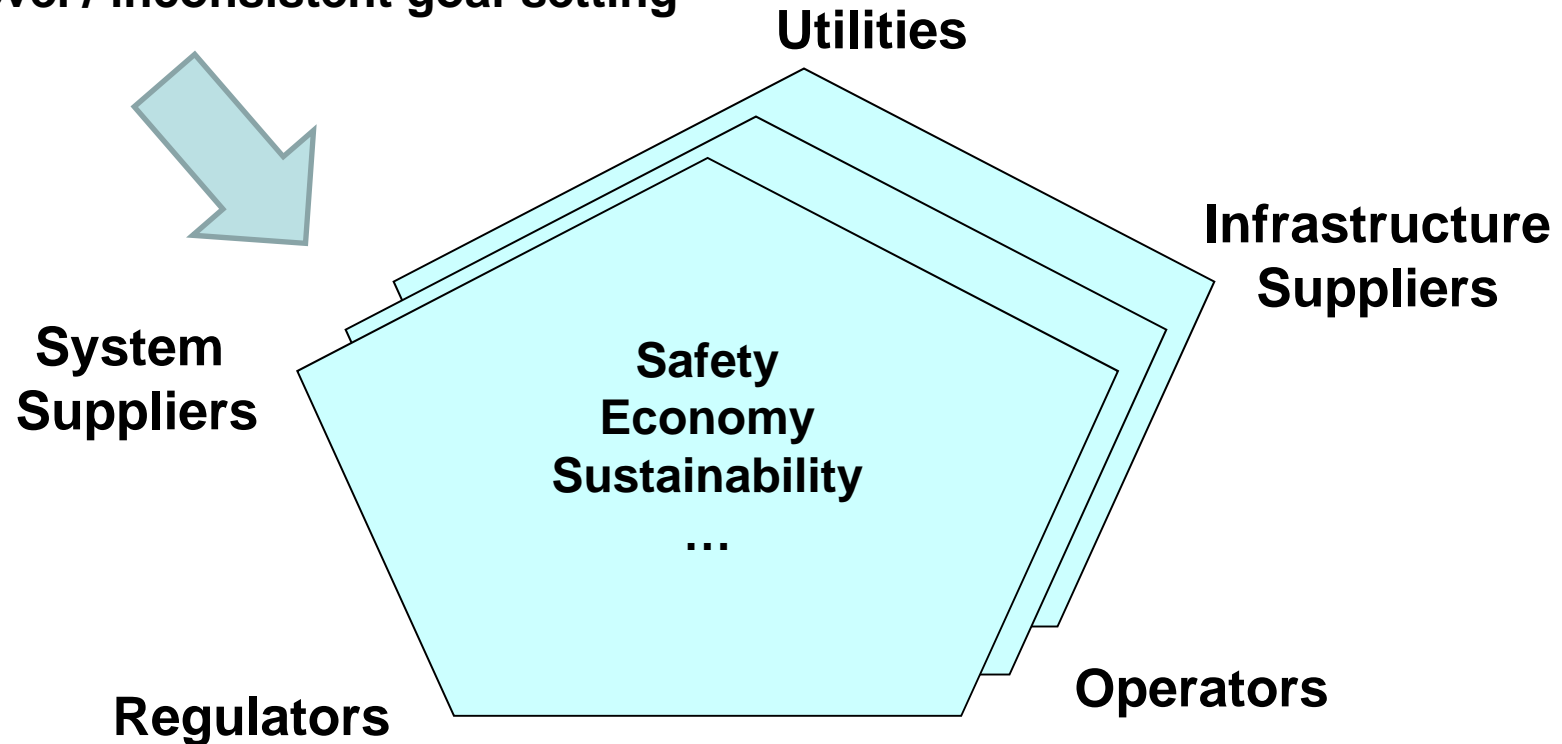
1. Yes, if adequate support is provided in the long term by appropriate education and societal recognition
2. Only if the disposal site is designed as a maintainable system

“If you think you are safe ...
... you did your first mistake”

Jim Reason

Thank you for your attention and participation

Ambiguous influence from the political level / inconsistent goal-setting



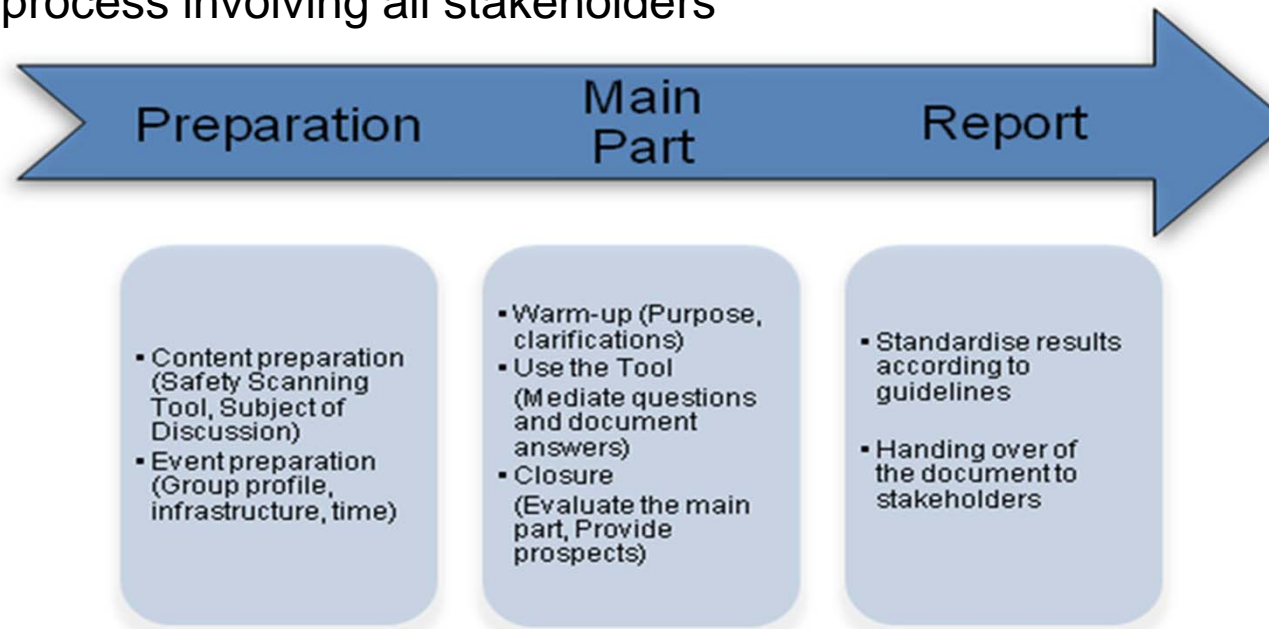
- Multiple interests and understandings on what is the 'best' solution
- Conflicting intentions leading to safety culture issues (neglect, avoidance)
- High potential of "intentional behavior" instead of task related behavior

Safety Scanning Technique (SST)

- Provides a means to share knowledge and experience
- Provides insights into inter-organisational conflicts
- Provides input into inter-organisational balanced score-cards

General Process

- A facilitated process involving all stakeholders



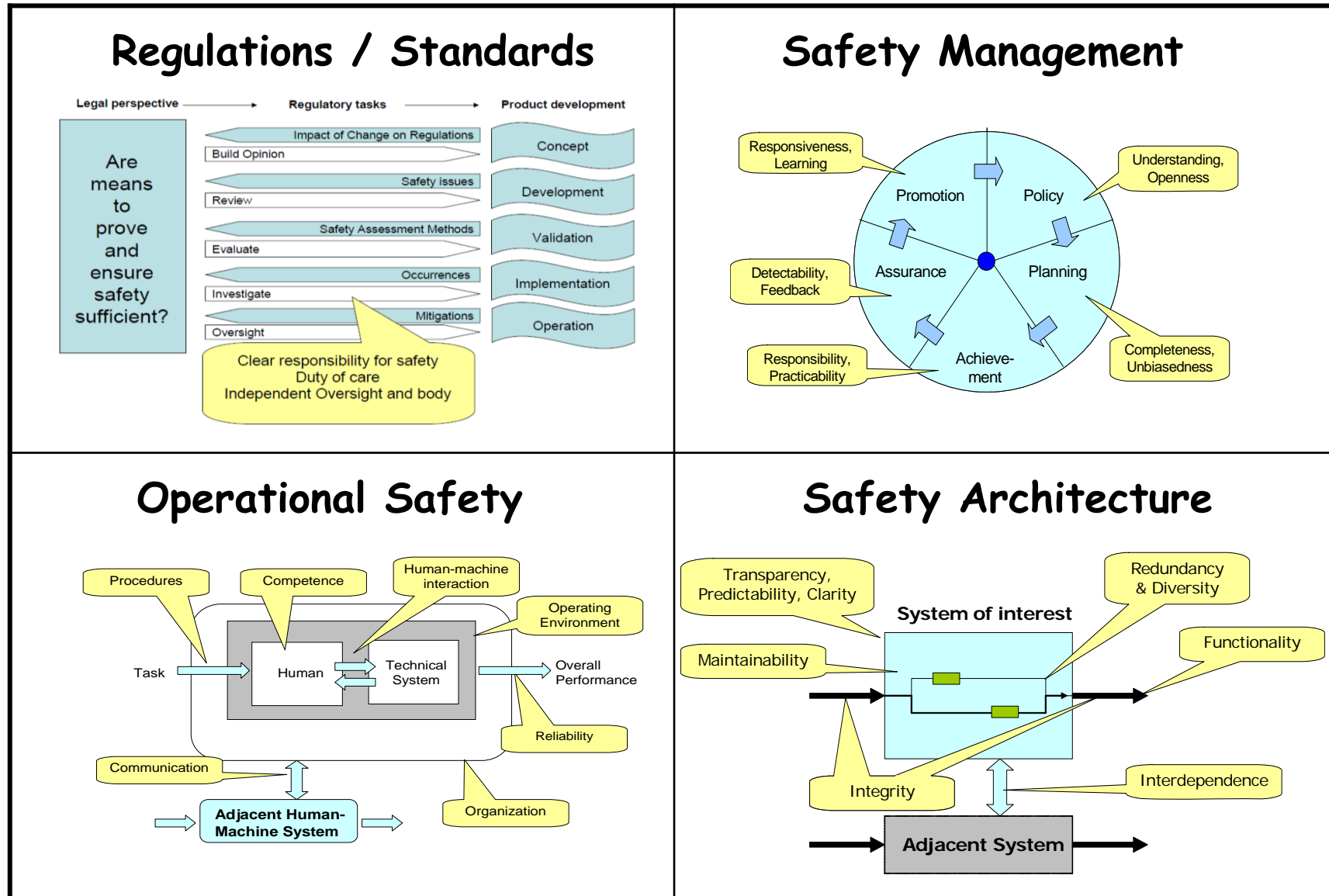
- Many applications: Galileo, Free Flight Concept, Railway- Restructuring, Airspace design, ...
- Establishment of a joint civil/military Airspace Flow Management Unit (AFMU) in the Netherlands, aiming at flexible use of airspace

– Participants:

- 1 Military policy maker
- 1 Civil policy maker
- 1 AFMU concept developer
- 3 Civil regulator
- 2 Civil ANSP
- 2 Military ANSP
- 1 Moderator
- 1 Co-moderator



Safety Fundamentals for integrating intentions



Safety Scanning tool – A Moderation Tool

Question navigator

Explanation

Question

Safety fundamental applicable to this page of questions

Possible answers

Room for providing justification

High-level question

Low-level questions

SESAR Safety Screening Tool

Question Navigator

* denotes justification required

Transparency Save Home Help

2) Is the description of the Subject transparent, clear and complete?*

Answer
 No Possibly Yes

Please enter your answer justification

2.1) Is there already a clear proposal on how to design the Subject?

Answer
 No Possibly Yes

Please enter your answer justification

2.2) Is the documentation of the Subject clearly understandable?

Answer
 No Partially Yes

Please enter your answer justification

2.3) Are there different opinions on how the Subject might work in detail?

Answer
 No Possibly Yes

Please enter your answer justification

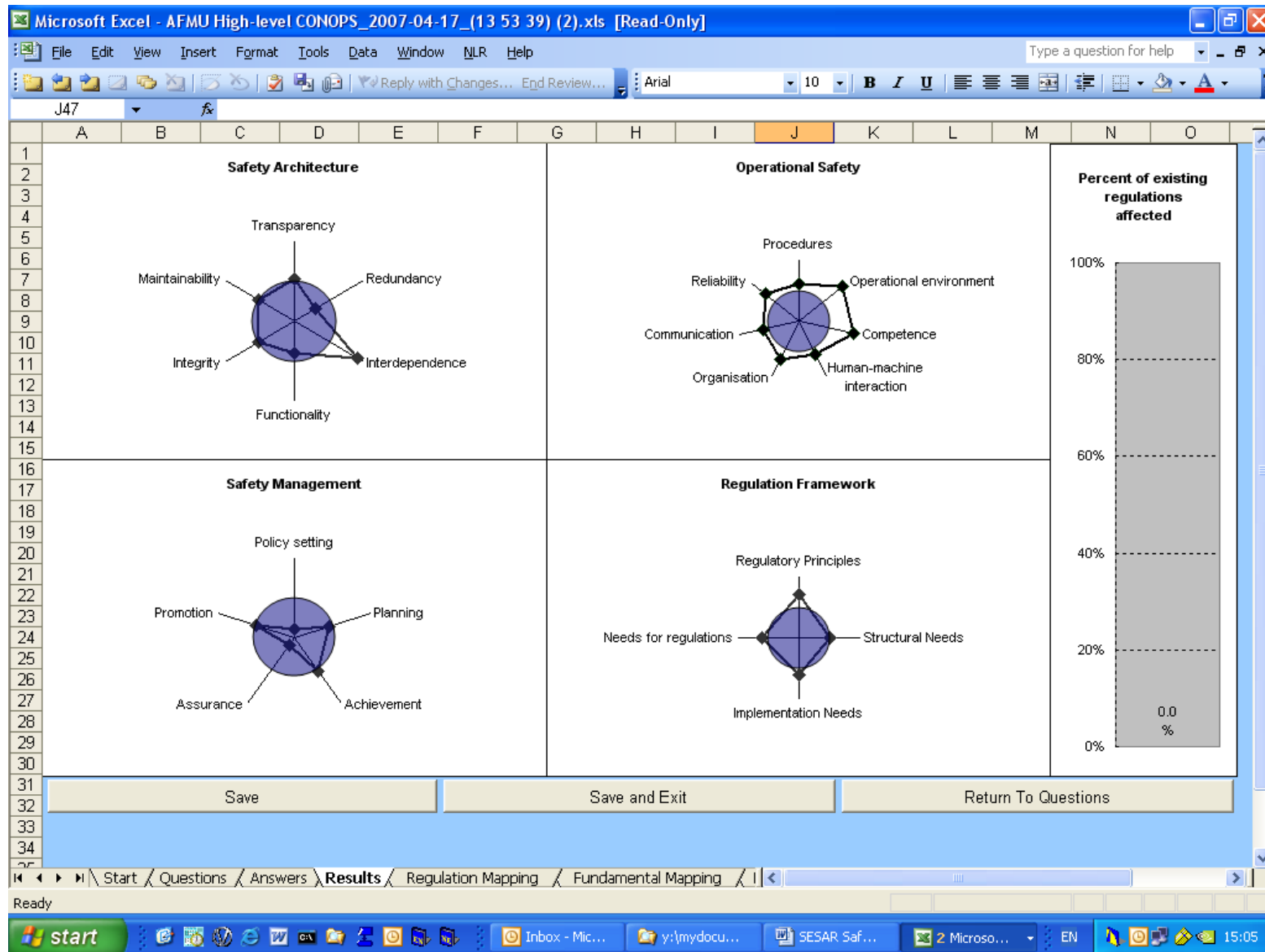
2.4) Are there preconceptions or decisions that have already been taken, while alternatives have not been sufficiently thought through?

Answer
 No Some Yes

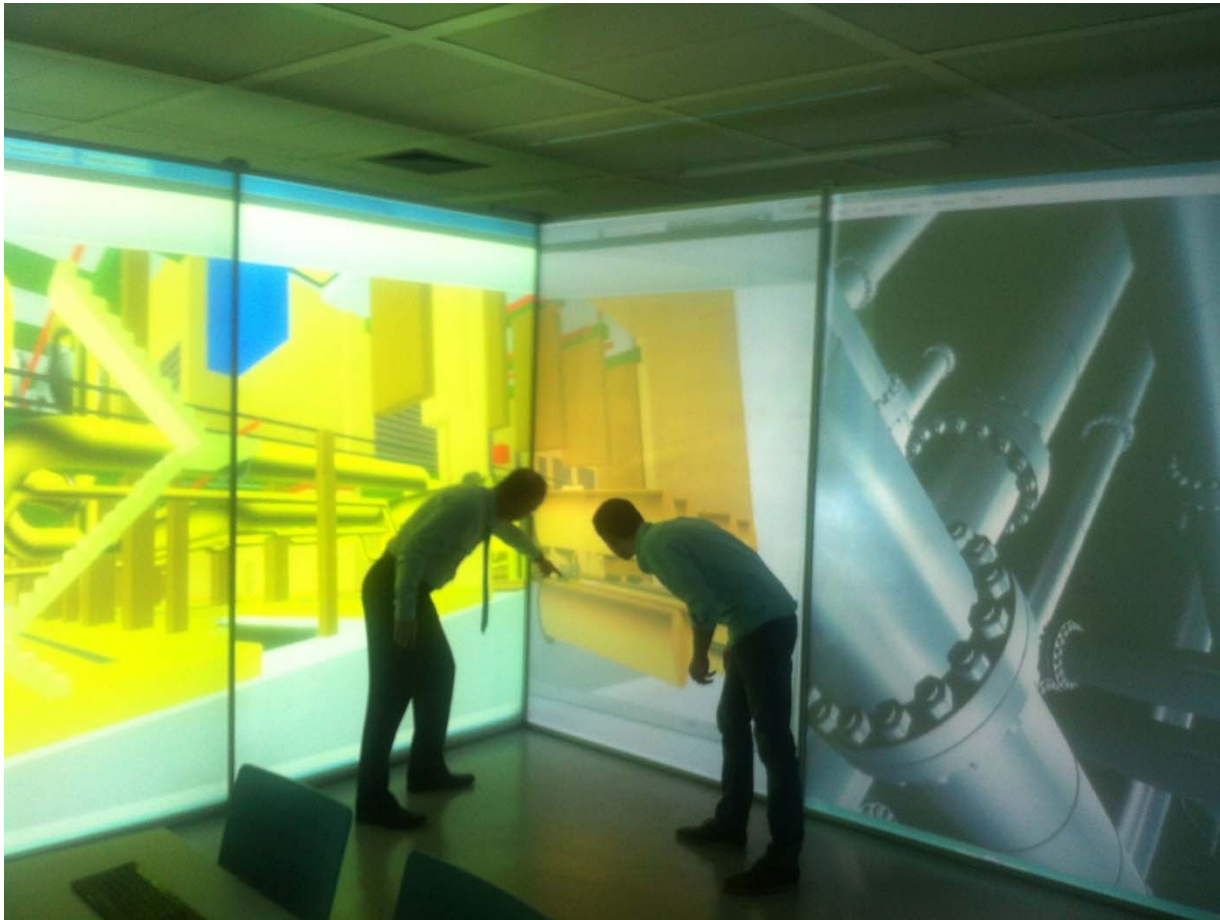
Please enter your answer justification

Progress through questions Back Finish Next

Example result



Resilient Planning using a Virtual Space



**Moderation of
conflicting goals**

Virtual plant visits

Safe Planning

- Hintergrund:
 - Kerntechnische Sicherheit und Begutachtung hinsichtlich MTO Aspekten
 - Promotion über Ereignisanalyse und menschliche Zuverlässigkeit
- Leitung des VDI Arbeitskreises Menschliche Zuverlässigkeit und Sicherheit
- Verantwortlicher für die Sicherheitsfragen des Single European Sky 2004-2008 (4 Jahre)
- RSK Unterausschuss Reaktorbetrieb von 2003 bis 2011 (8 Jahre)
- Expertengruppe Reaktorsicherheit (ERS) der ENSI/Schweiz seit 2011
- Mitglied des Ausschusses Betriebssicherheit des BMAS seit 2015