



Idaho National Laboratory

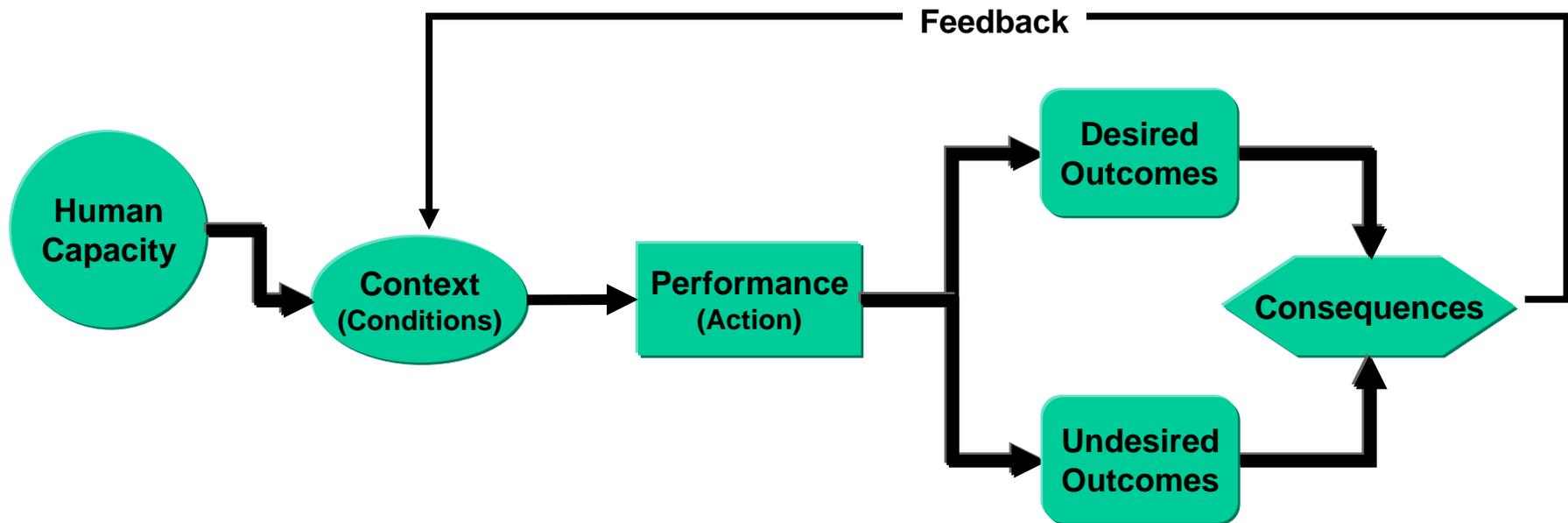
The Juxtaposition of Human Reliability and Human Performance

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BACKGROUND

- **Human error remains a dominant contributor to catastrophe, tragedy, and waste in the modern world**
- **As undertakings involving human oversight of complex technological systems increase, effective characterization, prediction, and countermeasures for human error are increasingly important.**
- **Sharing of information and expertise between different domains is a strategy for capturing the spectrum of issues and influences relative to disruptive errors**

A Model of Human Performance



Old View

- Human error is a cause of accidents.
 - To explain failure, we must seek and identify failure – that is, we must place blame (and shame).
 - *We must discover people's inaccurate assessments, wrong decisions, deviations from the rules, and bad judgments (Dekker, 2002).*

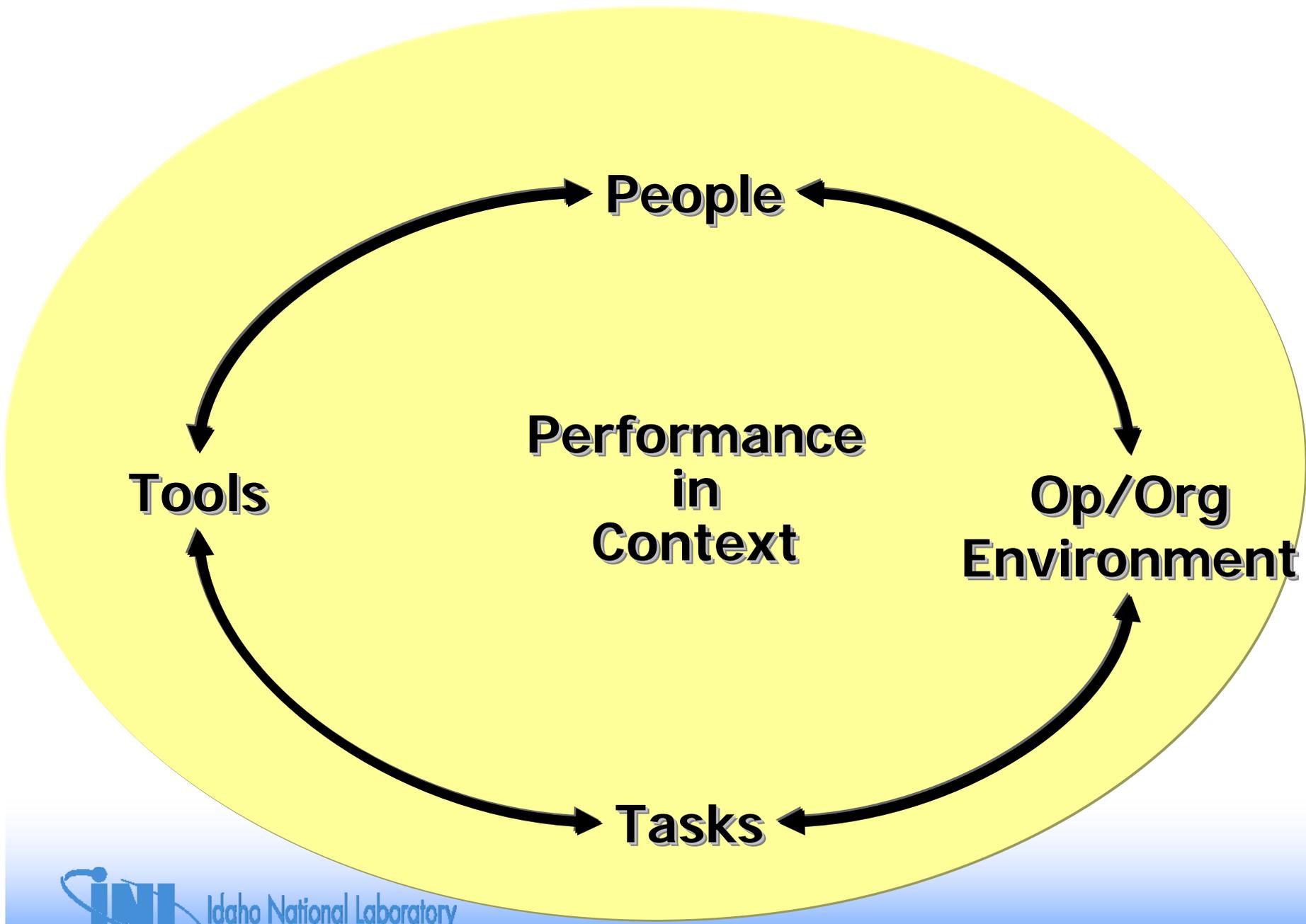
Our investigation revealed human error to be the primary cause of the ... incident.

– GAO Report GAO/OSI-93-4, pg. 2

New or System View

- Human performance is very much shaped by system context.
- If one is to really understand human performance, then one must first understand the context or 'landscape' in which the performance takes place.

People perform in context.



How new is the new view?

World War II Aircraft Incidents

- In the U.S. Army Air Force
 - 15,000 service personnel died in training and other aircraft incidents in the U. S.
 - Total aircraft losses amounted to 65,200. Of that number, 1/3 of these aircraft were destroyed in crashes within the United States.



Fitts and Jones (1947)

- **Discovered how features of WW II airplane cockpits systematically influenced the way in which pilots made errors.**
 - **Pilots confused the flap and gear handles. They typically looked and felt the same and were co-located.**
 - **Pilots often mixed up locations of throttle, mixture, and propeller controls because these controls kept changing across different cockpits.**

Some Conclusions

- **The label “pilot error” was deemed unsatisfactory, and should be used only as a pointer to hunt for deeper, more systemic conditions that can lead to failure.**
- **Human errors are systematically connected to features of people’s tools and tasks.**
- **Accordingly, we can re-tool, re-design, and thus influence the way in which people perform.**

**We know that under the right conditions,
simple mistakes and systemic organizational
weaknesses combine with deadly consequences.**



Active Factors

Latent Factors

Adverse Event Consequence

Exacerbating Factors

Mitigating Factors



Engineered Systems Do Not Work in Isolation

- Engineered systems' performance is determined by a variety of factors
 - Design, including margins of safety
 - Quality of materials and construction
 - Operability, including process and procedures
 - People
- All in the context of an organization
- All factors must be considered in the prevention of failure

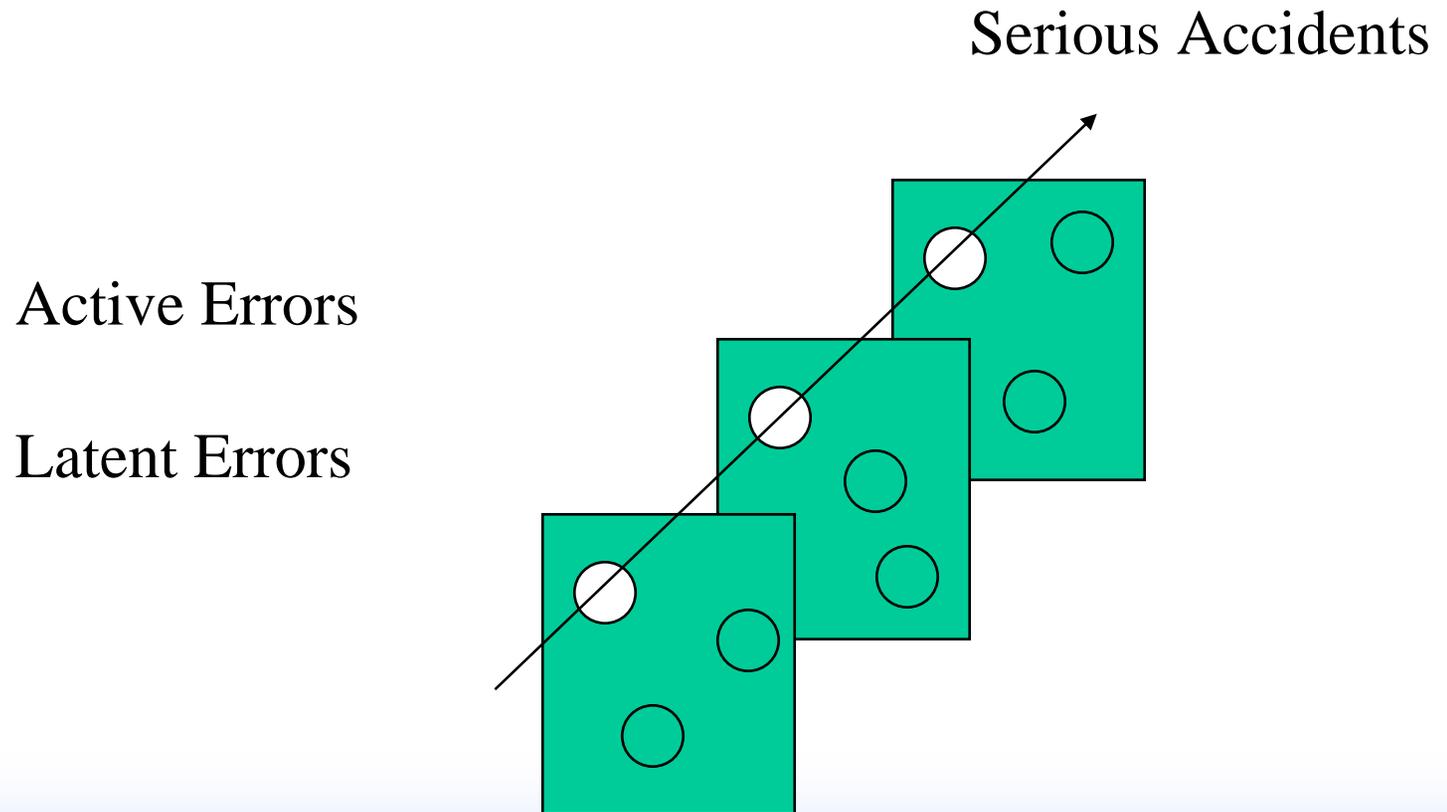
The real answer lies in-

- **Understanding the Task + Workplace + Organization**
- **Collecting the right information, treating people justly, being flexible enough to change, and really learning how to improve tasks, and workplaces.**

Error management is about managing the manageable

- **Fallibility is part of the human condition**
- **We are not going to change the human condition**
- **But we can change the conditions under which people work**

Human error on Swiss



Application of methods and tools from human factors are needed in accident prevention

- **Sharp End**
 - Behavioral based safety
 - Voluntary protection programs
 - FMEA
 - Design reviews
 - Walk downs
- **Blunt End**
 - Risk Assessment
 - Human reliability assessment
 - Accident precursor programs
 - Data bases and analysis

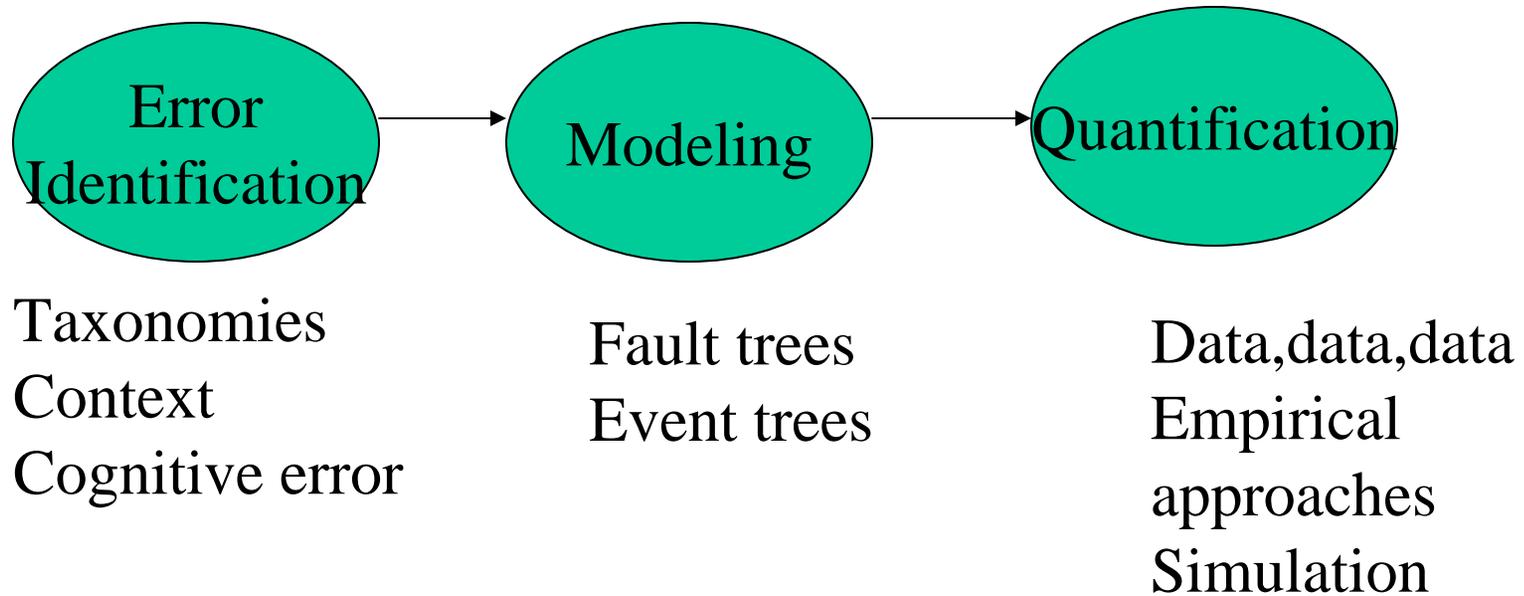
Operational programs such as BBS are directed at reducing error

- **BBS programs will reduce error and will effect culture**
- **These types of programs will lead to organizational learning in the right environments**
- **BBS programs will not in and of themselves lead to accident free environments**
- **Higher level analysis is necessary**

PRA and HRA support the deep understanding of how accidents occur and their risk

- **Through accident sequence analysis the effects of context, human error, equipment failure, cognitive error, common cause failures are studied**
- **This level of analysis is critical to understand how the complex connections can be made that lead to a catastrophe and at the same time yield an event probability and consequence**

Human reliability is the combination of three basic steps



HRA focuses on understanding the conditions that produce errors (context) and lead to the breakdown of multiple barriers.

Methods used today

- **Complete methods**
 - THERP
 - CREAM
 - HEART
- **Methods that focus on error identification**
 - ATHEANA
- **Methods that focus on quantification**
 - ASP

Are the methods reliable and valid, how good is the data

- **Not much progress in new data**
- **Not many additional studies on reliability and validity**
- **Tremendous amount of work in error identification, including errors of commission**
- **A lot of work still needs to be done, but the methods are being used and we are learning**

Major issues facing human reliability as a discipline

- Clearinghouse for models that describes uncertainty- error identification, error characterization
- Conduct studies to develop HRA data and methods (reliability, validity)
 - Same way as has been done for equipment
 - Specific objectives and ties to PRA and other regulatory decision making applications
- How are latent errors presently accounted for in failure rates
- What model, for what application

Human performance and human reliability methods are complimentary

- **Both approaches are necessary**
- **Neither approach alone is insufficient**
- **We need address the error reduction, error tolerance, and error recovery as well as the understanding of complex systems that leads to improved safety and productivity**