

# Human Behavior In Failure Analysis

**Please explain and describe what “human factors” is? A couple thoughts to refine your answer:**

1. I dont really mean ergonomics, but more on the human behavior side of human factors.
2. Make connections into, with, about, around these other topics: root cause analysis, failure analysis/investigation, failure mode and effects analysis, and retrospectives.

Human factors is a multidisciplinary field that focuses on understanding how humans interact with systems, products, and environments, with the goal of optimizing human well-being and overall system performance. While ergonomics is a part of human factors, the field also heavily emphasizes the psychological, social, and behavioral aspects of human-system interactions.

In the context of human behavior, human factors researchers and practitioners seek to understand how human characteristics, such as perception, cognition, decision-making, and communication, influence the way people interact with systems and each other. This understanding is crucial for designing systems that are safe, efficient, and user-friendly.

Human factors principles are closely related to various methods used in analyzing and preventing failures, such as:

1. Root cause analysis (RCA): Human factors play a significant role in identifying the underlying causes of incidents or accidents. By considering human behavior and decision-making processes, RCA can uncover the root causes of failures that may be related to human error, miscommunication, or inadequate training.
2. Failure analysis/investigation: Human factors experts contribute to failure investigations by examining how human actions or inactions may have contributed to the failure. This includes analyzing human-machine interfaces, communication breakdowns, and organizational factors that may have influenced human performance.
3. Failure mode and effects analysis (FMEA): Human factors considerations are integrated into FMEA to identify potential failure modes related to human interaction with the system. This includes assessing the likelihood and impact of human errors, as well as identifying measures to mitigate or prevent these failures.
4. Retrospectives: Human factors principles are applied in retrospectives or after-action reviews to identify lessons learned and areas for improvement in terms of human performance and interaction with systems. This involves analyzing how human behavior, communication, and decision-making processes influenced the outcome of a project or event.

By incorporating human factors principles into these analysis and prevention methods, organizations can develop a more comprehensive understanding of how human behavior contributes to system failures and successes. This understanding enables the design of more resilient systems that account for human strengths and limitations, ultimately improving safety, efficiency, and user satisfaction.

**Thanks! Now, lets go into more detail. Please give me 5 specific ideas, theories, methods, concepts, etc from human factors that should be explicitly taking into consideration when doing a failure analysis/investigation.**

Here are five specific ideas, theories, methods, and concepts from human factors that should be explicitly taken into consideration when conducting a failure analysis or investigation:

1. Situational Awareness: Situational awareness refers to an individual’s perception, comprehension, and projection of elements in their environment. During a failure investigation, consider how situational awareness may have been compromised, leading to human error. Factors such as information overload, distractions, fatigue, and stress can all impact situational awareness.
2. Decision-Making Models: Human factors researchers have developed various decision-making models, such as the Recognition-Primed Decision (RPD) model and the Naturalistic Decision Making (NDM) framework. These models help explain how experts make decisions in complex, time-pressured situations. When investigating a failure, consider how decision-making processes may have been influenced by factors such as time pressure, incomplete information, or conflicting goals.

3. **Human Reliability Analysis (HRA):** HRA is a method used to quantify the likelihood of human error in a system. It involves identifying potential human errors, estimating their probabilities, and assessing their consequences. When conducting a failure investigation, HRA can help identify the human error probabilities associated with critical tasks and inform recommendations for reducing the likelihood of future errors.
4. **Crew Resource Management (CRM):** CRM is a set of training procedures used in aviation and other high-risk industries to enhance teamwork, communication, and decision-making. CRM principles, such as effective communication, leadership, and situational awareness, can be applied to failure investigations to identify breakdowns in team performance that may have contributed to the failure.
5. **Human-System Interface (HSI) Design:** HSI design focuses on the interaction between humans and systems, including displays, controls, and software interfaces. During a failure investigation, consider how the design of the human-system interface may have contributed to the failure. Poor HSI design can lead to mode confusion, increased workload, and decreased situational awareness, all of which can contribute to human error.

By explicitly considering these human factors concepts and methods during a failure investigation, investigators can develop a more comprehensive understanding of how human behavior and performance may have contributed to the failure. This understanding can inform recommendations for system redesign, training, and procedural changes to prevent similar failures in the future.

**Ok, this is also great. A lot of this answer has to do with human-computer interaction.**

Lets do the same request for 5 explicit aspects of human factors when do a root causes analysis or retrospective into a failure around project management. For example, example a software team is trying to understand how an analysis for security of an important component of their software was missed.

When conducting a root cause analysis or retrospective into a failure related to project management, such as a software team trying to understand how a security analysis of a critical component was missed, consider the following five explicit aspects of human factors:

1. **Cognitive Biases:** Cognitive biases are systematic errors in thinking that can influence decision-making and judgment. Some relevant biases in project management include:
  - **Planning Fallacy:** Underestimating the time, resources, and risks associated with a project.
  - **Confirmation Bias:** Seeking or interpreting information in a way that confirms preexisting beliefs or assumptions.
  - **Grouptthink:** The desire for harmony or conformity within a group, leading to suboptimal decision-making.

When investigating the missed security analysis, consider how cognitive biases may have influenced the team's decision-making processes and led to the oversight.

2. **Organizational Culture:** Organizational culture refers to the shared values, beliefs, and norms that shape behavior within an organization. A culture that prioritizes speed over quality, or that discourages speaking up about potential risks, can contribute to failures like missed security analyses. During the retrospective, examine how the organization's culture may have influenced the team's priorities and decision-making.
3. **Communication Breakdowns:** Effective communication is critical for successful project management. When investigating the missed security analysis, consider how communication breakdowns may have occurred, such as:
  - Lack of clear roles and responsibilities
  - Inadequate documentation or knowledge sharing
  - Silos between teams or departments
  - Misaligned goals or priorities

Identify the specific communication challenges that may have contributed to the failure and develop strategies for improving communication within the team and organization.

4. **Mental Models:** Mental models are simplified representations of reality that people use to make sense of complex systems. In project management, team members may have different mental models of the project's goals, risks, and priorities. Misaligned mental models can lead to misunderstandings and oversights. During the retrospective, explore how differences in mental models may have contributed to the missed security analysis and develop strategies for aligning the team's understanding.
5. **Workload and Time Pressure:** High workload and time pressure can lead to increased stress, fatigue, and cognitive strain, which can negatively impact performance and decision-making. When investigating the missed security analysis, consider how workload and time pressure may have influenced the team's ability to identify and prioritize potential risks. Examine whether the team had adequate resources and support to manage their workload effectively.

By explicitly considering these human factors aspects during a root cause analysis or retrospective, the software team can develop a more comprehensive understanding of the systemic and psychological factors that contributed to the missed security analysis. This understanding can inform recommendations for improving project management practices, team dynamics, and organizational support to prevent similar failures in the future.