



Asking Questions to Discover Error Precursors (After the Fact)

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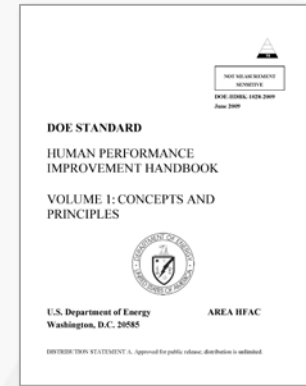
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Two Statements About Human Error

Human error is caused not only by normal human fallibility, but also by incompatible management and leadership practices and organizational weaknesses in work processes and values. (DOE HPI Handbook Vol. 1)



Errors take different forms, have different psychological origins, occur in different parts of the system, and require different methods of management. (James Reason, 1997)

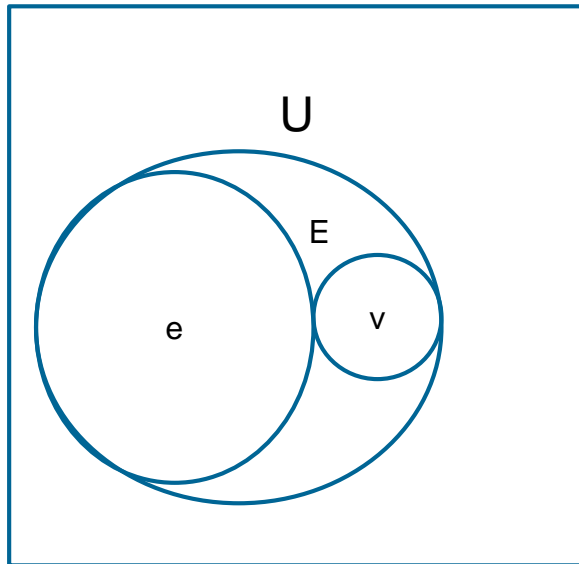




Approaches to Managing Human Error

We typically address human error by its type (form) and by temporal perspective:

General Type



U = human behavior
 E = human error
 e = errors (unintentional actions)
 v = violations (intentional actions)¹

Temporal Perspective

Before Error Occurs (Proactively)	After Error Occurs (Reactively)
Identify <i>potential</i> error precursors ² for this job	Identify <i>actual</i> error precursors & related facts
Identify error-likely situations ³ for this job	Find reasons why people did what they did & why it made sense to them at the time ⁸
Select error mitigation tools and error prevention tools ⁴	Identify active and latent errors ⁹ that occurred
Manage defenses in depth ⁵	Examine systems, processes, and defenses for weaknesses ¹⁰
Foster a culture that openly talks about errors when they occur ⁶	
Be a learning organization ⁷	

1. Reason. *Managing the Risks*, p. 72
 2. DOE HPI Handbook Vol. 1, p. 2-31[^]
 3. DOE HPI Handbook Vol. 1, p. 2-30
 4. DOE HPI Handbook Vol. 1, p. 2-33

5. DOE HPI Handbook Vol. 1, p. 3-1
 6. DOE HPI Handbook Vol. 1, p. 4-23
 7. DOE HPI Handbook Vol. 1, p. 5-8
 8. Dekker. *Field Guide*, p. 39

9. DOE HPI Handbook Vol. 1, p. 2-8–2-9
 10. DOE HPI Handbook Vol. 1, p. 3-22

Error Precursors

Error precursors are unfavorable conditions embedded in the job site that create mismatches between a task and the individual.

Error precursors interfere with successful performance and increase the probability for error.

Simply stated, they are conditions that provoke error.

Error precursors are, by definition, prerequisite conditions for error and, therefore, exist *before* an error occurs. If discovered and removed, job-site conditions can be changed to minimize the chance for error.

This is more likely if people possess an intolerance for error precursors or error traps.

Cyclical Nature of Addressing Error

See that learning from previous time(s) changes how we do it next time.

Overall Approach
Look for actual errors in the previous step(s).
Try to identify potential for errors in the next step.

Make changes to address errors and system causes.

Pinpoint system causes (failed defenses, latent org. weaknesses)

Implement Learning

Plan work

Prepare for Work

Execute Work

Review work

*Identify **probable** error-provoking conditions (error precursors).*

Look out for identified precursor conditions.

Try to capture and mitigate errors as they occur.

Openly discuss errors made and why they occurred.

*Identify **actual** conditions that provoked or exacerbated errors (error precursors), as well as decisions made.*

Error Precursors Listings

The error precursors listed below (in order of impact) were compiled from a study of INPO's event database and from human performance, ergonomics, and human factors sources. (See full list in HPI Handbook 1, Ch. 2, Att. A.)

This “short list” (aka TWIN) gives the *more common* conditions associated with events triggered by human error (in order of prevalence based on data).

Task Demands	Individual Capabilities
1. Time Pressure (in a hurry)	1. Unfamiliarity with task / First time
2. High workload (large memory)	2. Lack of knowledge (faulty mental model)
3. Simultaneous, multiple actions	3. New techniques not used before
4. Repetitive actions / Monotony	4. Imprecise communication habits
5. Irreversible actions ^a	5. Lack of proficiency / Inexperience
6. Interpretation requirements	6. Indistinct problem-solving skills
7. Unclear goals, roles, or responsibilities	7. Unsafe attitudes
8. Lack of or unclear standards	8. Illness or fatigue; general poor health or injury

Work Environment	Human Nature
1. Distractions / Interruptions	1. Stress
2. Changes / Departure from routine	2. Habit patterns
3. Confusing displays or controls	3. Assumptions
4. Work-arounds / OOS ^b instrumentation	4. Complacency / Overconfidence
5. Hidden system / equipment response	5. Mind-set (intentions)
6. Unexpected equipment conditions	6. Inaccurate risk perception
7. Lack of alternative indication	7. Mental shortcuts or biases
8. Personality conflict	8. Limited short-term memory

This is just the short list. See HPI Handbook Vol. 1 for full list of precursors.

DOE EFCOG HPI TG White Paper (Nov. 2020)

The main product of this effort, found in **Attachment 1**, consists of a table listing:

- common precursors, grouped by category
- the HPI Handbook definition
- questions that could be asked to help discover the precursor,
- assumptions associated with:
 - the precursor itself (as compared to others)
 - the setting in which questions about it would likely be posed
- notes to provide references to other precursors for similar but distinct conditions

Uses common language, so that user and listener need not be well-versed in HPI terminology to discover important elements of the task.

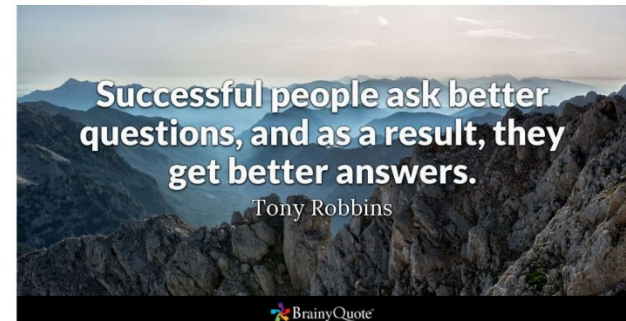
Also facilitates using questions less as an interrogation and more as part of a conversation in which a “questioning attitude” prevails.



Human Performance Improvement Task Group

Task 20-2

**Asking Better *Error Precursor* Questions for
Effective Job Planning, Pre-Job Briefs,
and Event Investigations**



Example of Precursor Questions Table Entry

Category	Precursor	DOE-HDBK-108-2009 description	Question to discover precursor presence	Assumptions in posing these questions
Task Demands	6. Interpretation requirements	Situations requiring “in-field” diagnosis, potentially leading to misunderstanding or application of wrong rule or procedure	<ul style="list-style-type: none"> • If a diagnosis or decision is required, how will the right diagnosis or decision be made? • Can this step be interpreted in multiple ways? • Do your work package (WP) or procedures provide you with adequate direction to perform a task or process? Are they vague? • Are the procedure steps clear and specific? • What other guidance do you need to do the task right? • Explain what you’re going to do for step X. <ul style="list-style-type: none"> ○ How is step X performed and what is your role in that? • Under what conditions should you pause/stop work? • What would you do if you were confused about a step in the written procedure? • Has there been an issue with any steps in the past? • Have you been unsure about any of the steps in the past? • Do you know who to go to for clarity? • Procedure writer: Have you observed the work to be done? • Planner: Did you look at the feedback from the previous jobs? • Planner: What was the feedback from the previous jobs? 	<ul style="list-style-type: none"> • Interpreting which requirements apply to the situation based on what is diagnosed is inherent in the task. • Misdiagnosis of the problem presupposes selection of the wrong course of action. • Diagnosis of the situation and an understanding of various courses of action based on the diagnosis are part of the skill base of the worker. <p>Note: For other types of misdiagnosis see: <i>Individual Capabilities – Indistinct problem-solving skills</i> (for potential errors due to underdeveloped problem-solving skills)</p>

Another Example of Precursor Questions Table Entry

Category	Precursor	DOE-HDBK-108-2009 description	Question to discover precursor presence	Assumptions in posing these questions
Work Environment	1. Changes/ Departure from routine	Departure from a well-established routine Unfamiliar or unforeseen task or job site conditions that potentially disturb an individual's understanding of a task or equipment status	<ul style="list-style-type: none"> • Are there any job site conditions that are different today that we need to be aware of? <ul style="list-style-type: none"> ○ Can any conditions change during task performance? ○ Could anything force you to do this task differently than normal? ○ What other obstacles in the work area do we have to adapt to, or manage? ○ Any environmental conditions that might impact this job? Examples include noise, weather changes, interesting activities that grab your attention, etc. ○ What will we do to remind ourselves of the changed condition? ○ Are there hazards that may change, causing reconsideration of controls or mitigating strategies? Do we need to do a Real Time Risk Assessment as the task progresses? • What is different today from our usual routine? • Are there any non-task related changes or departures from routine individual or team? <ul style="list-style-type: none"> ○ Is a critical team member away for training or out sick? ○ Is there anything different/new going on in this area? ○ Any work steps or procedures changed since the last time you executed this task? ○ Has there been a time change [from Daylight Savings Time]? • What about the system –its processes, equipment, or supporting systems – has or may have changed since we last did this job? • Is there a point at which we need to pause and re-brief? 	<ul style="list-style-type: none"> • Personnel being assigned have sufficient familiarity with the task and how it is typically performed, as well as the typical conditions in the area where it will be performed this time, to recognize steps that could be impacted by certain atypical conditions. <p>Note: Change/departures from routine may drive the worker from skill-based or rule-based performance mode, and he/she now may be in knowledge-based mode. The individual and/or team needs to fully understand the deviation before proceeding.</p> <p>Note: For other types of unfamiliar situations see also:</p> <ul style="list-style-type: none"> • <i>Human Nature – Assumptions</i> (for errors arising out of suppositions made without verification of facts) • <i>Individual Capabilities – Lack of Knowledge</i> (for errors resulting from lack of practical knowledge about the task)

Using the Questions Table (Planning, Pre-Job Brief)

As a tool, it is envisioned that the individual(s) who are preparing to conduct a job-planning session, a pre-job briefing, etc.,

would consider

- the nature of the task involved,
- the personnel involved, and
- the environment in which the work is scheduled to occur,

and would

- select specific questions from the table pertaining to the precursors that are most likely to exist for this instance, to be used in the meeting.

The “Top 10” List

Members of the HPI Task Group ranked the 10 questions that they believed were the most useful and would discover multiple error precursors.

Based on the ratings received, the 10 most-frequently-selected questions were identified.

As the Top 10 Questions are not all-inclusive to discover all precursors that may be present in the specific situation to be discussed, if you have the time to prepare, you should select the questions that you think will best discover precursors specific to the task and the work group that will be, are, or were involved.

Top 10 Questions to Discover Error Precursors

Under what conditions should you pause/stop work?

What potential interruptions or distractions might arise during execution of this task?

What is different today from our usual routine?

Are there any situations going on with the work team that can affect the deliverable?

What has to go right the first time and/or every time – in other words, are there critical steps or risk-important steps?

What do we “expect” to see and do as we begin work and/or as task performance progresses? How will we validate this is the actual condition?

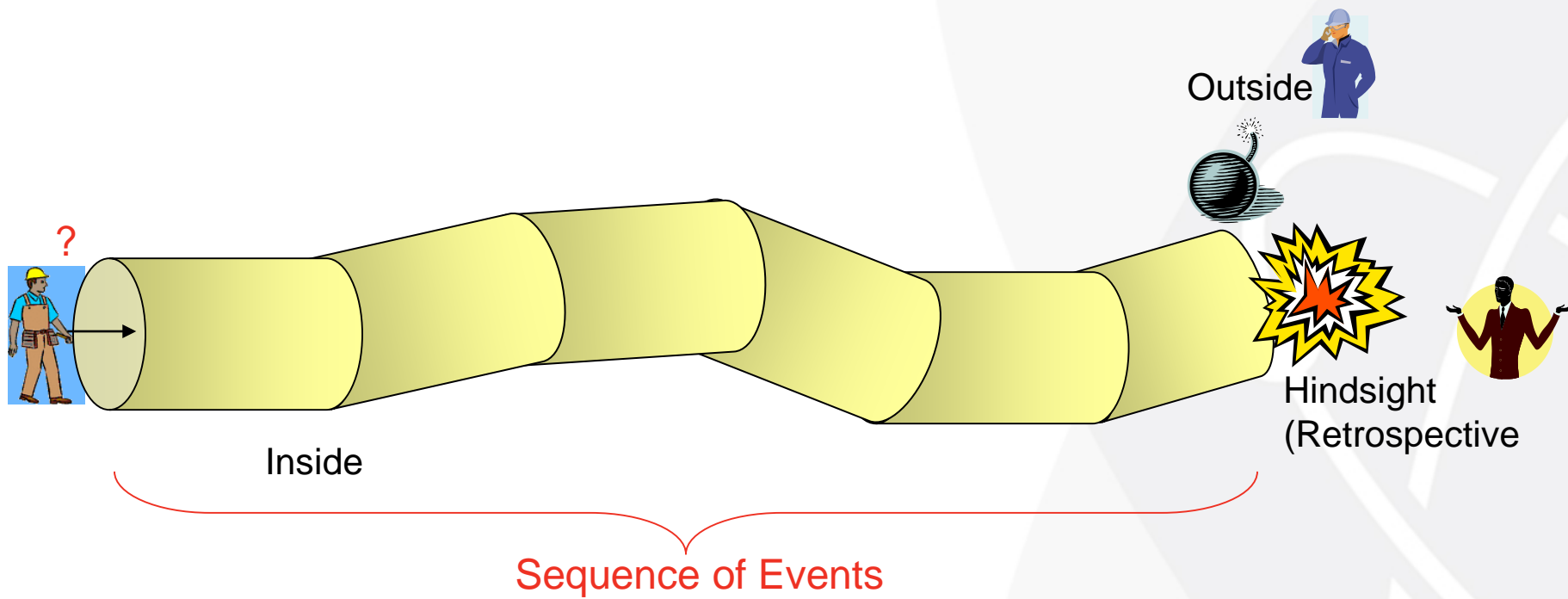
Is there anything new about how we are to perform this job?

Are there any aspects of the job or potential obstacles that could cause misunderstanding between team members?

What verbal communication tools are most effective for this particular job?

Even though we have performed this task a bunch of times before, is there some reason we should do some aspect/part of it differently this time?

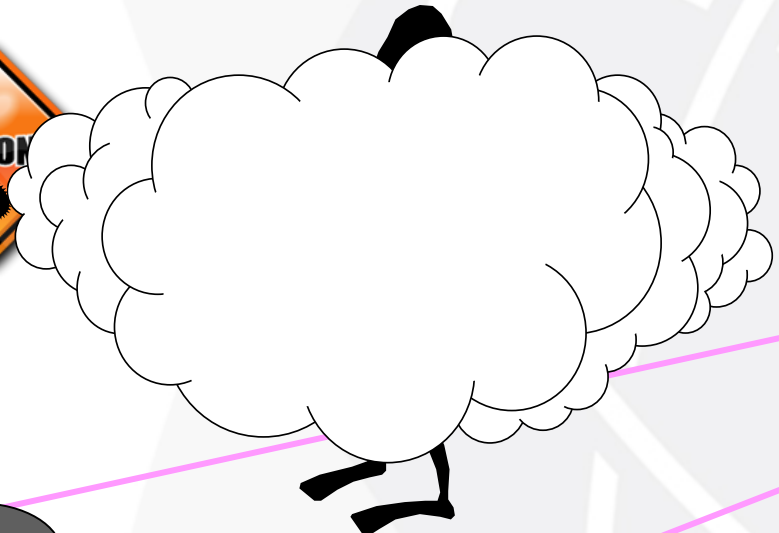
Different Perspectives (Temporal and Spacial)



Data in Context

There is a difference between:

- Data **availability**: what can be shown to have been physically available somewhere in the situation
- Data **observability**: what would have been observable given the context



Asking Questions to Discover Precursors After-the-Fact

The primary objective of precursors is for their potential to exist to be considered *before* work is performed.

When an event/incident has already occurred, your main objective when talking to those who were involved is to *facilitate learning*.

- Admittedly, it is hard to *not* sound accusatory or judgmental.
- Don't let your knowledge of what ultimately happened keep you from being open to seeing things how they were for them at the time.

The questions you ask about the conditions that existed, decisions they made, and actions they took need to help them remember and reflect so that learning can come from it, despite any errors or mistakes that occurred.

Questions from the HPI Error Precursors guide will need to be reworded so that the tense is in the past.

Basic Steps to Identifying Precursors After-the-Fact

- 1.** Review the facts and information available about the situation.
- 2.** Note key aspects of the situation, including differences from “normal/usual/typical”
- 3.** Note any “forks in the road” and/or (conscious) decisions made.
- 4.** Note any slips, mistakes, violations, etc. made by people involved.
- 5.** Consider key aspects (step 2) that may have facilitated the errors made (step 4).
- 6.** Consider precursors that correspond to the related key aspects (step 5) that likely existed.
- 7.** Select questions for the potential precursors (step 6) to see if they actually existed.
- 8.** Record the precursors that evidence confirms (step 7) were likely present before or during the sequence of events.

Data Reliability of After-the-Fact Error Precursor Data

Identification of error precursors for a workplace incident needs to be based on specific facts obtained from personnel directly involved in the situation or event.

Just because errors later occurred does not mean that a precursor was reasonably observable (i.e., recognizable, identifiable) beforehand by the persons involved.

Selection of precursors should be based on the full HPI Handbook definition of the precursor (not just the brief TWIN-card phrase). The EFCOG HPI Task Team White Paper on *Asking Better Error Precursor Questions* is also a good resource.

When logging precursors for a given incident, facts need to be documented with each precursor which will explain how/why it is believed that that precursor existed (to support data validation).

Review and Summary

Error precursors are conditions that provoke error, and thus interfere with successful performance by increasing the probability for error.

DOE HPI Handbook Vol. 1 provides valuable information about the list of the most frequently occurring precursors.

The EFCOG HPI Task Team White Paper *Asking Better Error Precursor Questions* provides additional tools to help understand precursors, and to identify and distinguish between them, as well as to discover them.

The greatest value in identifying *potential* error precursors is during the planning, preparation and execution of a job.

When an event/incident has already occurred, your main objective when talking to those who were involved is to *facilitate learning*.

If information about an accident or workplace incident expressed in terms of error precursors is desired, care has to be taken to make sure that precursors actually existed and were reasonably recognizable to the people involved, so that data will be reliable.

Discussion and Questions as Time Allows

Thank you for your attention and participation.

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