From: The Field Guide to Understanding Human Error

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Summary

Two Views on Human Error

Old View
- Human error is a cause
- To explain failure, you must find errors, violations, incompetence, mistakes
- You must identify an employee's inaccurate assessments, wrong decision, bad judgments

New View
- Human error is a symptom of a problem in the system
- To explain failure, do not try to find where people went wrong
- Find how employee's assessments and actions made sense at the time, given the circumstances that surrounded them

Two Views on Human Error

Old View
- Complex systems are basically safe
- Unreliable humans undermine defenses, rules and regulations
- To make safer, restrict the human contribution (automation, tight procedures, strict supervision)

New View
- Complex systems are not basically safe
- Complex systems are trade-offs between multiple irreconcilable goals (safety and productivity)
- People have to create safety through practice at all levels of the organization

Can we agree that…

- Employees do not come to work to do a bad or unsafe job.
- Employees are trying to reconcile multiple goals in a complex, dynamic setting.
- Hindsight is 20/20.
- The present is unfolding in front of us; we can only call it history in retrospect.

Can we agree that…

- The person or thing closest in time and place (proximal) to the event may not be the parameter that caused or could have prevented it.
- Accidents rarely have one cause.
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Reprimands or Removal

- "Reprimanding 'bad apples' is like peeing in your pants. You feel warm and relieved at first, but soon you look like a fool to others."
- Removing bad actors leaves a trap in place for the next person
- Drives reporting of real problems underground
- Is cheap and easy, saves face of supervisors, shows activity

Local Rationality

- People were doing reasonable things given the complexities, dilemmas, trade-offs and uncertainty that surrounded them.
- To understand human error you have to push until what they did makes sense.
- Human error is the other side of expertise or expert practice – the outcome of a negotiation while faced with ambiguous evidence and uncertain outcomes.

What are the motivations for an investigation?

- We don't know why or what – and that is scary
- Want to start investing in countermeasures
- Want to know how to adjust behavior to avoid same incident
- Want to blame someone and get justice

We have to give up 2 myths:

1. There is no ONE cause or even a root cause. Causes are not found they are constructed based on the accident model.
2. The “system” is safe, it was a human or mechanical failure. We will find that the line between human error and mechanical failure is going to be blurry

Cause is something you construct

- “Cause is the identification, after the fact, of a limited set of aspects of the situation that are seen as necessary and sufficient conditions for the observed effect(s) to have occurred. The cause is constructed rather than found.”

Hollnagel, E. (2004). *Barriers and Accident Prevention*. Aldershot, UK; Ashgate Publishing Co.

- *"For every complex problem there's a solution that is simple, neat and wrong." H.L. Mencken*

Henry Louis "H. L." Mencken (September 12, 1880 – January 29, 1956), was an American columnist, essayist, magazine editor, satirist, acerbic critic of American life and culture, and a student of American English. Mencken, known as the "Sage of Baltimore", is regarded as one of the most influential American writers and prose stylists of the first half of the 20th century.

What is the Accident Model?

- The Sequence of Events Model
- The Epidemiological Model
- The Systemic Model

A model brings order and helps explain relationships.

A model constrains:

- not all incidents are linear
- incidents are related to latent failures
- incidents occur due to interactions between system components – the normal workings of the system under resource / knowledge/ time constraints

…the wildness lies in wait

"The real trouble with this world is not that it is an unreasonable world, nor even that it is a reasonable one. The commonest kind of trouble is that it is nearly reasonable, but not quite. Life is not illogicality, yet it is a trap for logicians. It looks just a little more mathematical and regular than it is, its exactitude is obvious, but its inexactitude is hidden; its wildness lies in wait. "

G.K. Chesterton

RM History

Building a timeline and leaving a trace

- What should be the beginning? (The event furthest from the incident?)
- This is usually resolved by starting with incident and working backwards
- What were others doing around them that overlapped in time and space?
- Explain what happens in between.

So, if it wasn't human error, what was it?

- Human Performance can go wrong due to:
  - Cognitive fixation
  - Plan Continuation
  - Stress, Fatigue
  - Buggy or inert knowledge
  - New technology, Computerization and Automation surprises
  - Procedural adaptations.

"Sense-making" is on-going

- There are situations without well formulated diagnosis of the problem
- People have to make provisional assessments of what is going on based on partial and uncertain data.
- Situation assessment and corrective actions are tightly interwoven- they constrain and inform each other
- Taking action commits to a particular interpretation.
- Taking action builds the explanation that justifies their action. ("Faced with the choice between changing one's mind and proving that there is no need to do so, almost everyone gets busy on the proof. John Kenneth Galbraith")

Cognitive Fixation

Cognitive fixation biases people in some direction – they are trying to come up with some plausible explanation.

Incoming information may contradict the explanation but they may not give up their explanation.

- People make one of two choices:
  - "Thematic vagabonding" – jumping from explanation to explantion – prevents a coherent picture from emerging
  - Cognitive fixation – can lead to obsolete understanding.
- Only hindsight tells you which was the way to go.

Information is always incorrect or incomplete….

The information you have is not the information you want.

The information you want is not the information you need.

The information you need is not the information you can obtain.

The information you can obtain costs more than you want to pay.

Plan Continuation

- Sticking with the original plan while a situation has actually changed and calls for a different plan.
- Early cues say the plan is correct; later cues are fewer, ambiguous, and not as strong. Conditions change gradually.
- Is abandoning the original plan costly?
- The evidence that the plan should have been abandoned may only by compelling in hindsight

Stress

- Can be caused by demand – resource mismatch
- Consequences of stress can be
  - Tunneling – seeing and increasingly narrow portion of one's operating environment – human nature is to try to form a stable, robust idea of a shifting world that may be uncertain
  - Regression –tendency to revert to earlier learned routines even if not entirely appropriate to the current situation – an unconscious effort to free up resources

Stress

- Perception of time can be distorted under conditions of extreme stress – fewer mental resources are available to track time; attention to time cues is diverted
- This occurs not because of a persons motivation, but because of autonomous redistribution of cognitive resources

Fatigue

- Impairs judgment about how fatigued you actually are
- Lapses in vigilance occur when waking hours are extended
- Fatigue affects controlled processes more (response and decision making) and affects routine behaviors less

Fatigue

- Can be the result of
  - Workload intensity or inactivity or sustained effort
  - Physical and psychological exertion
  - Sleep deprivation
  - Time of day effects
  - Circadian desynchronization

Effects linked to fatigue

- Reduced vigilance
- Cognitive slowing
- Memory effects
- Lapsing or “microsleeps” – 10 sec not responding to external stimuli

Buggy or Inert Knowledge

- Employees need to
  - Possess the knowledge
  - Have the knowledge organized such that it is available for the situation at hand
  - Activate the knowledge in context
- Was the training adequate?
- Was the training presented in a way that it was contextual and retained?

Computerization/Automation Surprise

- Getting lost in mode or display architecture
- Workload or data overload
- Not noticing changes – requires cognitive work by a human
- Automation surprises – system did something that the user did not expect

Texas A&M Bonfire Collapse

- Incremental growth over time allowed builders to take repeated success as indications that the construction was being well managed.

Erosion of safety margin

The process may become hazardous long before overt failure occurs.

- Accident was unanticipated despite precursor event

Fundamental surprise

"Minor" incidents signal presence of hazard but may go unnoticed before accident occurs.

Procedural Adaptations

- Procedures are not sensitive to subtle variations in context, people interpret them
- Applying procedures is a cognitive activity
- Multiple procedures may need to be applied at once
- Hindsight can blame for either:
  - Stick to the procedure – can lead to error in the face of unanticipated events
  - Adapt the procedure in the face of the same unanticipated event can also lead to error

Procedural Adaptations

- "Failed to follow procedure" is counterproductive. What signals did organization send in advance of the incident?
- Solution: invest in employee understanding of the reasons behind the procedure and adaptive strategies that work and do not work.

Does this mean there is no personal responsibility?

- An employee's behavior placed is context may not seem so deviant or unexpected or ill-advised.
- Given everything surrounding them at the time, they thought their behavior made sense. You might have also.
- The system surrounded them, look at the system.

"Human Error" …. is a symptom , not a cause

- Human error is not the cause of failure, but is a symptom of failure
- Human error – by any other name or by any other human --- should be the starting point of our investigations, not the conclusion.
- If the "cause is Human Error", if you replace one human with another, have you prevented recurrence?

Three Ways Humans Perform

- Knowledge Based (figure it out)
  - Work within your knowledge base; know what you don't know; decision making aids/resources
- Rule based (if you do this, then this will happen)
  - Education, procedures, peer coaching, policy detail and clarity, task simplification, equipment design, task location, job aids near work site, intuitive procedures
- Skills based (train like you work, then you work like you train)
  - Checklists, self-check, visual reminders, second-person check, verification points, automation

So the corrective action will have to do with one of these.

An employee plays the hand he is dealt…

- Can you hold the employee accountable?

Accountability = Responsibility + Authority

- If you cant show that the employee had the authority to live up to the responsibility that you are now asking of them, the call for accountability has no merit.

A look at the organization. What is the role of the Safety Dept?

- Tabulator of irrelevant or unusable data that no one uses?
- Compiler of the compliance paper trail?
- Cheerleader for past safety records or to meet new goals?
- Cost center.
- The Dept that is excluded from organizational decision making that affects the trade-off between production and safety?
- Nagger for systemic safety recommendations with respect to incidents while line management nails the employee involved?

Safety needs to …

- Provide leading indicators: qualitative intelligence on what is actually going on (audits, inspections, meetings, JSAs, PPE adjustments, re-training, PM, …)
- Educate the safety practitioners…position does not make you an expert.
- Be sensitive to organizational and productivity concerns
- Be organizationally as independent as possible.

Writing recommendations

- A recommendation is a hypothesis– a prediction that if this is changed, it will have a certain effect on human behavior. It is an experiment
- Using SMARTER will help recommendations get organizational traction.

High-end vs Low-end Recommendations

- High- end: aims at structural decisions regarding resources, technology. Will not be as easy to implement
  - "We have a procedure for that already"
  - "Employees are trained to deal with that"
  - "The recommendation is not relevant to the incident"
- Low-end: not very sweeping; concentrate on few individuals or small subsection of the organization. Potential that system problem is left in place.

Specific questions to get help from employees

- What would have helped you to get the right picture of the situation?
- Would any specific training, experience, knowledge, procedures, or cooperation with others have helped?
- If a key feature of the situation would have been different, what would you have done differently?
- Could clearer guidance from your company have helped you make a better trade-off between conflicting goals?

Reasons for Failure of Recommendations

- Low-end recommendations are favored because the organization is looking for one-shot fixes
- Safety change is not managed like Quality – no mechanism for continual improvement; no person to steward the change.
- No mechanism for feedback about the success or failure of the recommendation (it was an experiment and we don't look at the result!)

How to make a change

Barriers to Change

- Old view judging behavior
- Resource constraints: trying to do more with less
- Decide that tighter supervision is the answer
- Expect that employees are more committed to safety than you exhibit
- Using language such as: they should have; they failed to.

Overcome the Barrier

- Recognize that people at all levels contribute to safety or risk through goal trade-offs
- Investigate the gap between "work as imagined" and "work as done" (VSM?)
- Find authority-responsibility mismatches
- Use language of situations and structures, that recognizes constraints and opportunities for individual action.

Triggers for Change

- Put a freeze on all “old view” countermeasures
- Examine how we learn from our failures
- Find the organizational incentives that contribute to poor decision making
- Accept that safety is created by people’s practice
- Practice “New view” countermeasures that acknowledge conflicting goals and help people manage them.

The End