Human Factors
~ Advancing Safety ~

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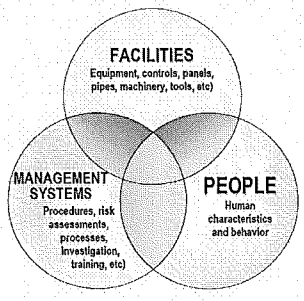
Question...

What is / are human factors?

WHAT ARE HUMAN FACTORS?



HUMAN FACTORS ARE:
The application of scientific knowledge about:

- People
- Facilities
- Management Systems

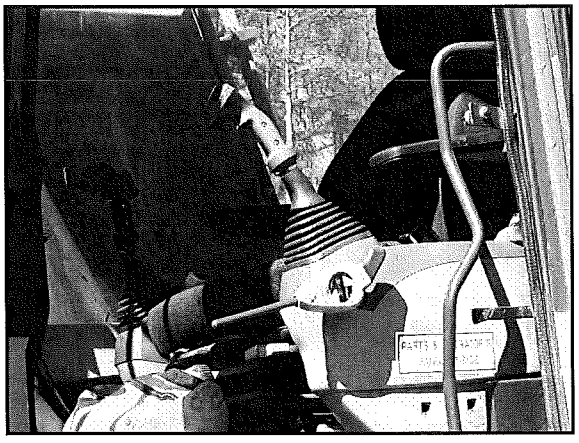
to improve their interaction in the workplace.

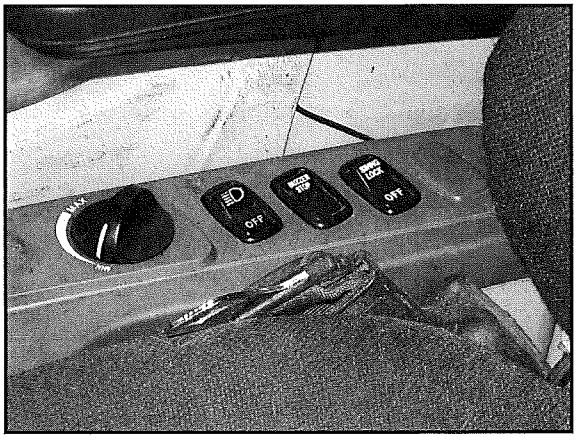
Human Factors Addresses...

The nature of the human interfaces

Physical	**Psychological**
Physiological	**Psychosocial**

It is about applying the science so that we can develop effective and appropriate recommendations





Accident Investigation
~Traditional Approach~

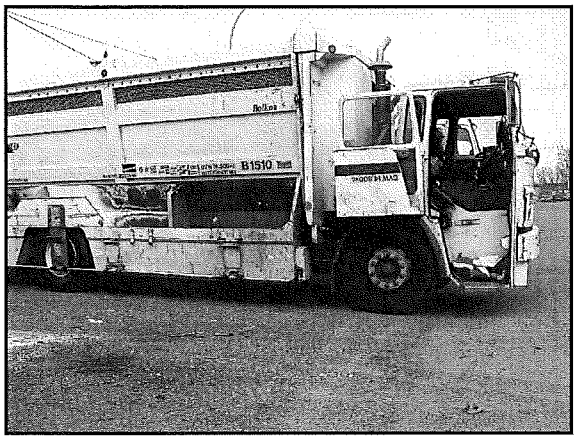
- Focus on proximate cause...(often unsafe acts by operator)
- Attach blame for failure to.....assess risks, follow procedures, pay attention

Accident reports depict:

WHO? | WHAT? | WHEN?

The old view of error

- The workplace system would be fine if not for a few unreliable people in it
- Human errors cause accidents
- Failures are introduced to the system only through the inherent unreliability of people



Human Factors Approach

WHO? WHAT? WHEN?

Expands:

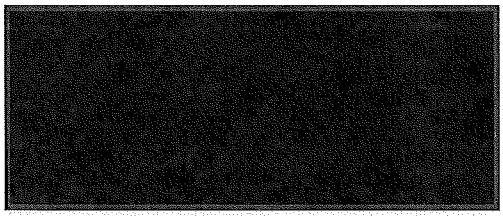
HOW? WHY?

The new view of error

- Human error is not the cause of failure. It is the effect or symptom of deeper trouble
- Human error is not random. It is systematically connected to the tools, environment and work process
- Human error is not the conclusion of an investigation, it is the starting point.

*Normal **people doing** normal **work***

Error is a NORMAL human condition.



"Nobody goes to work to do get injured"

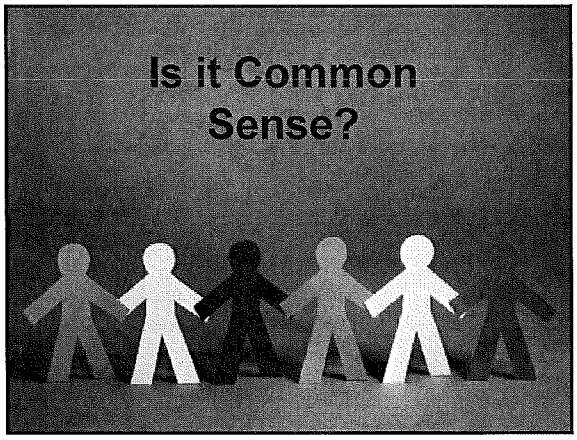
- Workers don't *decide* to make errors - *they do things that made sense at the time*
- Their decisions were based on what they saw – *not what you happen to know today."*

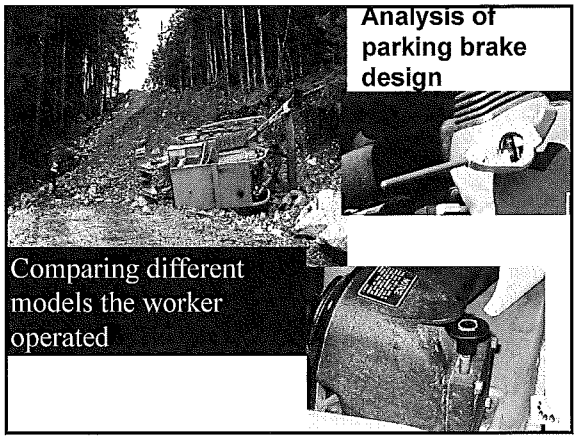
Getting Past the Surface

- The label of "human error" is a symptom of deeper trouble
  - "he screwed up"
  - "he wasn't paying attention"
- The human factor (worker(s)) is central in an investigation and there is interaction between the human and each of the analysis elements.

Common sense

Consists of what people in common would agree on: that which they "sense" (in common) as their common natural understanding. So "common sense" is the knowledge and experience which most people allegedly have, or which the person using the term *believes* that they do or should have.

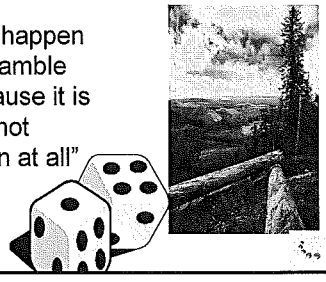


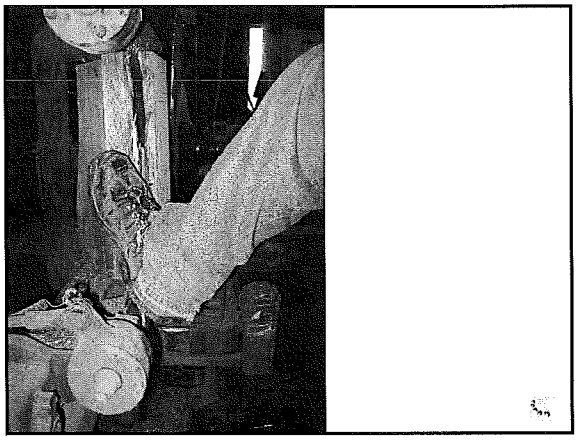


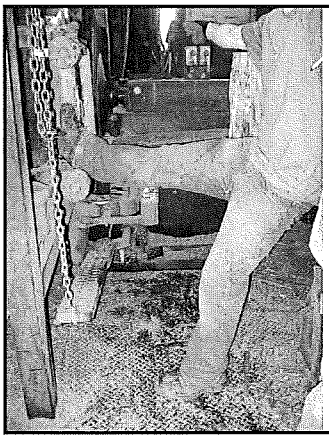
Human Factor Approach

~Trading Indignation for Understanding~

- "Accidents do not happen because people gamble and lose, but because it is believed that it is not possible to happen at all"





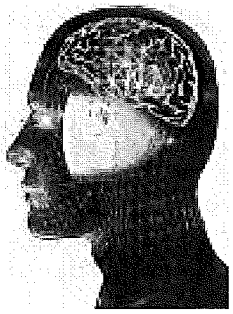


- Brake pedal function
- Manufacturer requirements
- Poor wood quality
- Guarding
- Production incentives
- Housekeeping
- Instruction and training

What were they thinking???

" The reconstruction of the mind set begins not with the mind. It begins with the circumstances in which the mind found itself"

Dekker (2002)



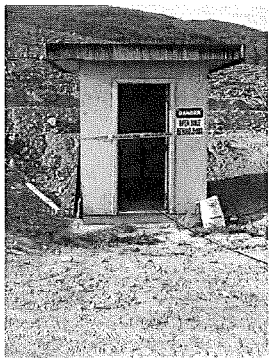
Human Factors Evaluates...

The interaction of the human in the environment with system influences

System characteristics of error:

- Inadequate or ambiguous information/feedback to the operator
- Requires performance beyond operator capabilities
- Reliance on human memory

Sullivan mines

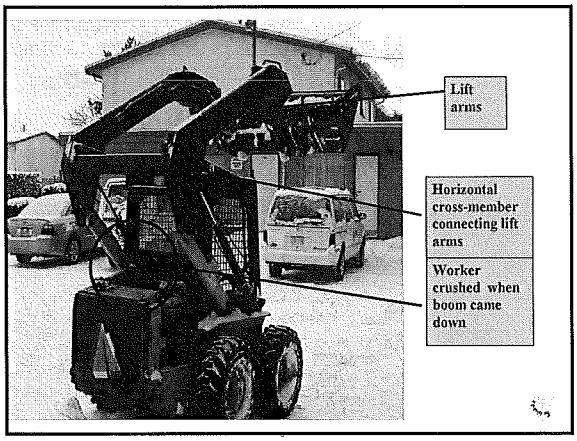


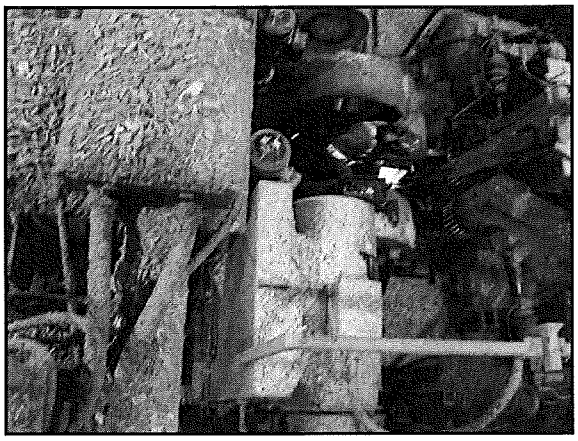
- Warning of physical hazard
- No visual, olfactory or other sensory cues
- Understood that they were attending to a conventional injury situation

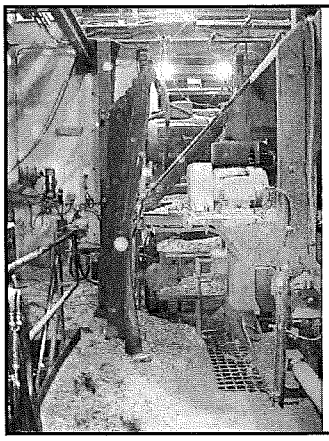
Enacted Sensemaking

- Making sense of their world
- delicate trade-off between dangerous action which produces understanding and safe inaction which produces confusion
- "This will make sense once I explore it" - although now it seems senseless
- Action is guided by preconceptions

Weick, Karl. E.



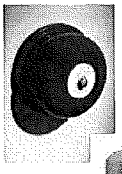




Chip deflector curtain

Mechanisms for altering consciousness?

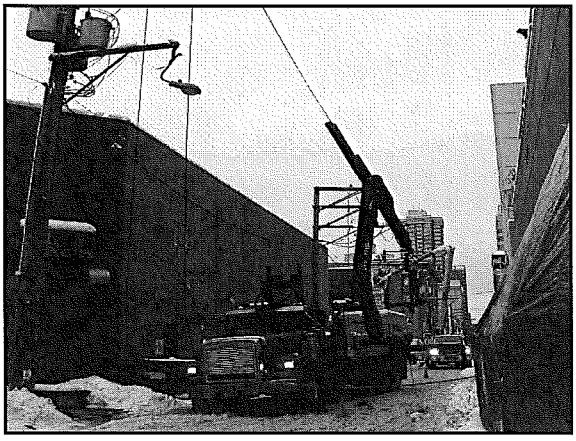
Dynamic warnings



- Captures attention
- Provides a stimulus change
- The burden of noticing the omission is placed on the system rather than the worker

Balance of responsibilities

SMS



Turning his back to danger...

"The **single** most reason I was injured was because I had my back to the machine"

- Be alert at all times
- Ask questions
- Look out for yourself and others
- Be aware of your rights
- Follow safety protocols (even when you're rushed)

"Rather than being the main instigators of an accident, operators tend to be the inheritors of system defects created by poor design, incorrect installation, faulty maintenance and bad management decisions. Their part is usually that of adding the final garnish to a lethal brew whose ingredients have already been long in the cooking".

(Reason, Human Error, 1990)

Effective investigations

Challenges

- Scope of the investigation:
  - easier to focus on those who committed the error (bad apple fallacy)
  - "can of worms" – impact on workload, timelines
  - hidden concerns (paranoia) of legal liabilities
- Problem definition –
  - "This is just finding excuses for the operator's poor judgement"
  - "This is not our problem"

Five Fallacies

- We already do it
- It undermines established investigation authority
- Our operation is different
- No time or money for it
- It is just common sense

Cognitive Obstacles

Knowledge of Results

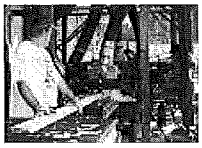
"Apparent clarity of retrospection..."

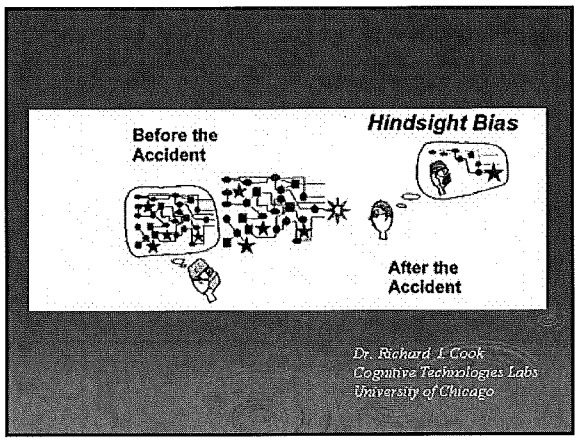
Investigators know the outcome of the chain of events. The challenge is to view the events leading up to the occurrence through the same lens as did those involved in the occurrence: They expected a different outcome

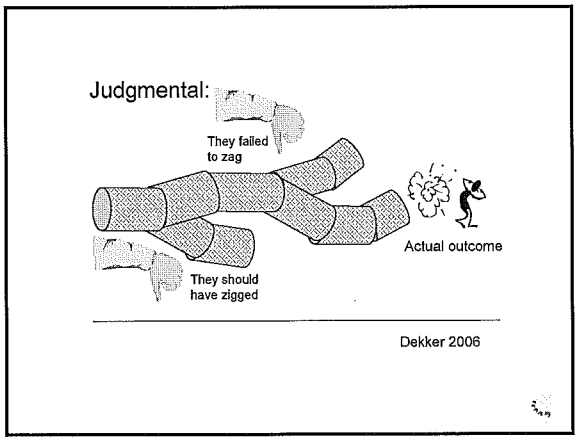
Cognitive Obstacles

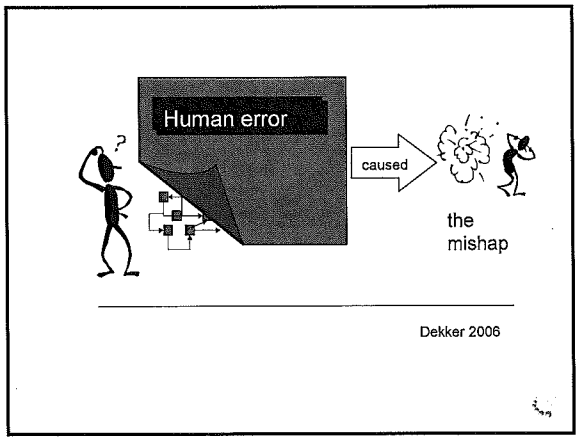
- Hindsight Bias

To exaggerate what the "worker" should have been able to anticipate in foresight




Hindsight Bias
Before the Accident
After the Accident
Dr. Richard I. Cook
Cognitive Technologies Labs
University of Chicago

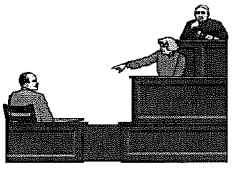

Judgmental:
They failed to zag
Actual outcome
They should have zigged
Dekker 2006


Human error
caused
the mishap
Dekker 2006

Cognitive Obstacles

- Fundamental Attribution Error:

"blame people and their characteristic, rather than situational factors"



Our willingness to pronounce a judgement or express an opinion on the world of human behavior.

Cognitive Obstacles

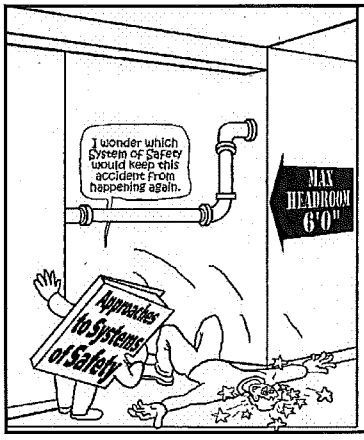
Labeling human error

- Starting point – why did the event occur?
  - Error is a symptom of deeper trouble

Cognitive Obstacles

- **Confirmation Bias**

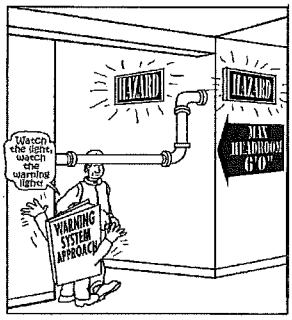
Leads one to see information that confirms our expectation rather than see information that contradicts our expectation.



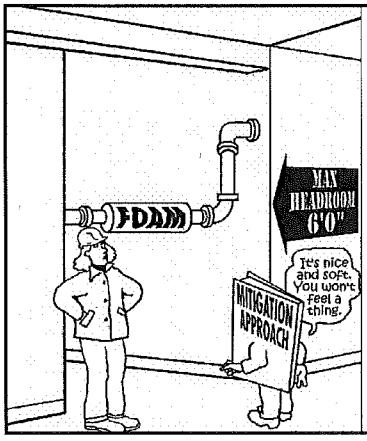
Which system will be the best to prevent a new accident?

Solve the problem by providing PPE

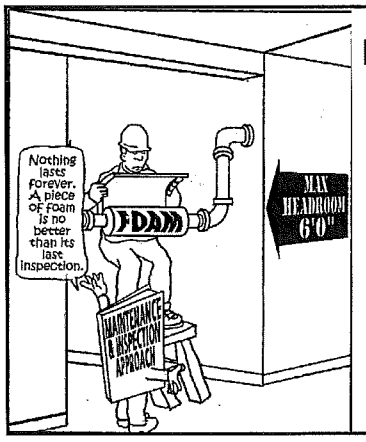
Use procedures and training



Use alarms and warning signs



Mitigation



Maintenance and inspection

Design and elimination will always be the first and best choice to reduce the risk and hazards!

Hierarchy of Safeguarding Controls		
Most effective (less supervision)	1. Elimination or substitution	•Eliminate human interaction in the process •Eliminate pinch points (increase clearance) •Automate material handling
	2. Engineering controls (safeguarding technology)	•Mechanical hard stops •Barrier guards •Interlocked guards •Presence-sensing devices •Two hand controls
	3. Awareness means	•Lights, beacons, and strobes •Computer Warnings •Restricted space painted on floor •Beepers, horns, sirens •Warning signs & labels
	4. Training and procedures (administrative controls)	•Safe work procedures •Safety equipment inspections •Training •Lock-out procedures
Least effective (more supervision)	5. Personal protective equipment	•Safety eyewear •Face shields •Hearing protection •Gloves •respirators

"Everyone, and that includes you and me, is at some time careless, complacent, overconfident, and stubborn. At times each of us becomes distracted, inattentive, bored, and fatigued. We occasionally take chances, we misunderstand, we misinterpret, and we misread. These are completely human characteristics."

Al Chapanis, Former Professor of Human Factors Engineering Department, Johns Hopkins University

"Because we are human and because all these traits are fundamental and built into each of us, the equipment, machines and systems that we construct for our use have to be made to accommodate us the way we are, and not vice versa."

Al Chapanis, Former Professor of Human Factors Engineering Department, Johns Hopkins University

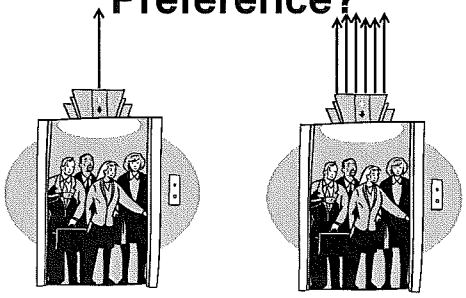
Systems Approach

- Humans have many limitations and capabilities.
- Design the workplace to be compatible with the human – the physical, the physiological, the cognitive and the psych-social.

Error prevention

- Change attitude towards error
- Understand the behaviour
- Minimize cause – effective recommendations
- Make errors visible
- Make errors reversible

Preference?



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