The Interface
Voluntary Protection Program

Recognition of Safety Excellence

Why Do We have Mishaps?
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Human Behavior
Objectives

- You will explore the human task interface
- Know the importance of human factors in safety
- Understand your cognitive limitations in the workplace.
Why do we get injured in the workplace?
Possible Reasons

- You are exposed to hazards in the workplace.
- There is risk of injury and illness when you interface with work equipment or task.
- Workplace conditions or the environment changes
- Equipment or systems can fail
Five Most Common Incidents

- Slips trips, and falls.
- Being Caught In or Struck by Moving Machinery.
- Transportation and Vehicle-Related Accidents.
- Fire and Explosions
- Overexertion and Repetitive Stress Injuries
Direction of causation

THREATS
- Procedures
- Work preparation
- Job factors
- Personal factors
- Competence and training
- Teamwork
- Supervision
- Organisational/Safety culture
- Work environment
- Human-machine interface
- Tools and equipment

SITUATION AWARENESS
- Attention
- Detection and perception
- Memory
- Interpretation
- Decision making
- Assumption
- Response execution

ACTION ERROR
- Omission
- Timing
- Sequence
- Quality
- Selection
- Communication errors
- Rule violations

ERROR RECOVERY
- Behavioral response and detection cues

Direction of analysis

ACCIDENT

NEAR MISS
Seven Most Common Causes

- Workers take shortcuts at work
- Workers are overconfidence.
- Inadequate Housekeeping.
- Starting a task before getting all necessary information
- Neglecting safety procedures and rules
- Mental Distraction
- Lack of Preparation
Big Picture on Causation
Enviromental Factors
Equipment Configuration
Human Factors
HUMAN FACTORS

Users

Use Environment

Device/Interface

DEVICE USE

Safe & Effective

Unsafe & Ineffective

Human factors considerations for industrial designers.
WAREHOUSE WORKER CRUSHED BY FORKS OF LASER GUIDED VEHICLE

INCIDENT FACTS

REPORT #: 71-171-2018s
REPORT DATE: 5/10/2018
INCIDENT DATE: 12/9/2015
VICTIM: 45 years old
Employed at facility for approximately one year
INDUSTRY: Bottled water manufacturing
OCCUPATION: Warehouse dock coordinator
SCENE: Water bottling plant warehouse
EVENT TYPE: Crush
Photo of the automatic laser guided vehicle (LGV) involved in the incident.
The victim was working in the warehouse when an LGV alarm was activated. Shortly after, another worker heard noises over the radio and looked into the warehouse to investigate.

He saw the victim slumped over one of the LGVs. The LGV then started moving again, and the other worker hurried to it and initiated an emergency stop. He could see that the victim had severe injuries to his chest and jaw.

He called for help and called 911. Emergency responders arrived within minutes and transported the victim to a local hospital where he was pronounced dead.
Example of a plastic “stringer” that would often tear off of the wrapping around the pallets of water bottles during loading and unloading and become caught on LGV forks. Stringers hanging from the forks that entered an LGV’s safety detection field would trigger an alarm and pause automatic movement.
The manufacturer’s manual required workers to initiate an emergency stop before removing an obstacle detected by the LGV. An LGV would then have to be manually reset before restarting its task. Without initiating an emergency stop, the LGVs would resume automatic function immediately after an obstruction was removed.

There were warning signs affixed to the vehicle indicating that workers should avoid standing beneath the elevated forks.
Sticker on the LGV indicating that working underneath elevated forks was prohibited.

Diagram indicating the location of the emergency stop button and rope pull. An identical set was present on the other side of the LGV.
After the incident, the company trained employees to initiate an emergency stop before clearing an obstacle from an LGV’s path, and to use a long-handled snipping tool to remove plastic stringers instead of reaching or bending under the forks of the LGV.
Requirements

Employers must protect workers around PITs (powered industrial trucks), and not allow them under the elevated part of any PIT, whether it is loaded or empty.

Recommendations

FACE investigators concluded that, to help prevent similar occurrences, employers should:

Train workers about the specific hazards associated with automated guided industrial vehicles, like LGVs. Emphasize that workers are expected to follow required safety procedures every time, and ensure compliance through periodic refresher training and spot checks.
Environment

Interface

Work Task

People
Task Interface

Knowledge

Situational Awareness

Risk Perception
Photo of the automatic laser guided vehicle (LGV) involved in the incident.
Causes of **USE ERRORS**

- **Perception**
  - Failure to see or hear information

- **Cognition (Processing)**
  - Forget information or step
  - Forget or apply rule incorrectly
  - Misinterpret information

- **Action**
  - Inability to reach a control
  - Use incorrect control
  - Use a control incorrectly
  - Failure to activate control

*Source: FDA Draft Guidance: Applying Human Factors and Usability Engineering to Optimize Medical Device Design, 2011*
Human

Thoughts → Action → Sensory Perception → Understanding

HCI

Input Interface → Action Recognition

Output Interface → Rendering

Computer

Task Execution

Washington State Department of Labor & Industries
Cognitive Capture
FATALITY NARRATIVE

Photo of the automatic laser guided vehicle (LGV) involved in the incident.

REPORT #: 71-171-2018s
The intention is correct but it is not carried out

Figure 1: Three Interacting Sub-Systems.
Unsafe Behavior
Failures in Attention
An error at the task interface can be deduced by error precursors.
## Error Precursors (short list)

<table>
<thead>
<tr>
<th>Task Demands</th>
<th>Individual Capabilities</th>
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</thead>
<tbody>
<tr>
<td>• High workload (memory requirements)</td>
<td>• Unfamiliarity with task / First time</td>
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<tr>
<td>• Time pressure (in a hurry)</td>
<td>• Lack of knowledge (mental model)</td>
</tr>
<tr>
<td>• Simultaneous, multiple tasks</td>
<td>• New technique not used before</td>
</tr>
<tr>
<td>• Repetitive actions / Monotony</td>
<td>• Imprecise communication habits</td>
</tr>
<tr>
<td>• Irrecoverable actions</td>
<td>• Lack of proficiency / Inexperience</td>
</tr>
<tr>
<td>• Interpretation requirements</td>
<td>• Unsystematic problem-solving skills</td>
</tr>
<tr>
<td>• Unclear goals, roles, or responsibilities</td>
<td>• “Can do” attitude for crucial task</td>
</tr>
<tr>
<td>• Lack of or unclear standards</td>
<td>• Illness or Fatigue</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Environment</th>
<th>Human Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Distractions / Interruptions</td>
<td>• Stress</td>
</tr>
<tr>
<td>• Changes / Departure from routine</td>
<td>• Habit patterns</td>
</tr>
<tr>
<td>• Confusing procedure / Vague guidance</td>
<td>• Assumptions</td>
</tr>
<tr>
<td>• Confusing displays / controls</td>
<td>• Complacency / Overconfidence</td>
</tr>
<tr>
<td>• Work-arounds / OOS instrumentation</td>
<td>• Mind set (intention)</td>
</tr>
<tr>
<td>• Hidden system response</td>
<td>• Inaccurate risk perception</td>
</tr>
<tr>
<td>• Unexpected equipment conditions</td>
<td>• Mental shortcuts (biases)</td>
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<tr>
<td>• Lack of alternative indication</td>
<td>• Limited short-term memory</td>
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</table>
How is the Interface Managed?
Summary
Workplace Culture