Cognitive Distraction & Attentional Error

Bringing Science to the Rail Industry

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Agenda

• Background: Root Cause Analysis

• Major Rule Violations: *A Scientific Perspective*

• A Step Change in Safety Performance
  – A New Perspective on Employee Responsibility
  – A Paradigm Shift for Management

• Opportunities

• A Path Forward
Background: Root Cause Analysis

- Major Rule Violations (Q4 2009)
  - Uncertainty as to cause(s)
  - Lack of consensus on corrective action
- Root Cause Analysis (2009 – 2010)
Major Rule Violations 2005 – 2009

Number of Major Rule Violations

Year

- 2005
- 2006
- 2007
- 2008
- 2009
Major Rule Violations Prior & Post Accident

- **Red Signal**
  - Prior to Accident: 1
  - Post Accident: 6

- **Form B**
  - Prior to Accident: 2
  - Post Accident: 1

- **Speeding**
  - Prior to Accident: 3
  - Post Accident: 4

- **6.32.2**
  - Prior to Accident: 0
  - Post Accident: 0

- **Switch**
  - Prior to Accident: 0
  - Post Accident: 0

- **Near Miss**
  - Prior to Accident: 0
  - Post Accident: 0

- **Other**
  - Prior to Accident: 0
  - Post Accident: 0

**Number of Violations (in 17 Months)**
Causes of Major Rule Violations

- Experience: 20%
- Judgment: 6.5%
- Violation: 6.5%
- Attention: 67%
Cognitive Distraction & Attentional Error

So what exactly are we talking about?
Cognitive Distraction & Attentional Error

“Instances where we are distracted or lose focus on the task at hand when..."
Cognitive Distraction & Attentional Error

... our attention wanders to a concurrent task(s) ...
Cognitive Distraction & Attentional Error

... or to unrelated internal thought(s) ...
Cognitive Distraction & Attentional Error

… or when we act automatically based on past experience regardless of the present circumstances”
Cognitive Distraction & Attentional Error

Workplace Distractions:
The Anatomy of a Red Signal Violation
Cognitive Distraction & Attentional Error

Bringing Science to the Rail Industry
Human Limitations

- Attention
- Perception

Safety Performance
Attention: A Limited Resource

Behavior is governed by two distinct brain systems
Behavior is governed by two distinct brain systems

Attention: A Limited Resource

Controlled

- Intentional
- Effortful
- Conscious

Task-at-hand

Automatic

- Habitual
- Routine
- Unconscious
Attention: Overload

Other tasks take attentional resources away
**Attention: Overload**

Other tasks take attentional resources away.
Attention: Overload

Other tasks take attentional resources away.
Attention: Overload

Other tasks take attentional resources away
Other tasks take attentional resources away
Attention: Overload

Other tasks take attentional resources away
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Other tasks take attentional resources away
Attention: Overload

Solution: Reduce the number of other tasks
Attention & Mind Wandering

Internal thoughts also take attentional resources away.
Internal thoughts also take attentional resources away
Internal thoughts also take attentional resources away.
Internal thoughts also take attentional resources away
Attention & Mind Wandering

Internal thoughts also take attentional resources away.
Internal thoughts also take attentional resources away
Internal thoughts also take attentional resources away
Rumination

My manager never acknowledges me...

Maybe he thinks I am not a good employee...

Maybe I am going to get fired...

How will I provide for my family?
Errors Lead to More Errors

- Did I just make an error?
- Did anyone see that?
- Will I be disciplined?
- Will I be fired?

Reason (1988)
Three States of Mind Wandering

- Momentary Absence
- Disengage Detail
- Disengage Global Task

Cheyne, Smilek et al., 2009
Consequences of Mind Wandering

Smilek, Carriere & Cheyne (2010)
Some tasks require very few attentional resources
... because they can be accomplished by the automatic system
Attention: Underutilization

Internal thoughts will fill the void
Attention: Underutilization

Internal thoughts will fill the void
Attention: Underutilization

Internal thoughts will fill the void
When more attention is needed for a task, it is not available.
Workplace Attention and Awareness Survey

Operating Employees

The following questions are to be considered in the context of you being actively engaged in your duties as an engineer or conductor while your train is in motion under normal running conditions.

... I catch myself losing attention to the task-at-hand.

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<tr>
<th>almost never</th>
<th>rarely</th>
<th>sometimes</th>
<th>often</th>
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... I do my duties automatically without thinking about them.

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... I find I have to exert effort to keep my attention focused on the immediate task-at-hand.

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... I find that I make errors when I am thinking about something other than the immediate task-at-hand.

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... I momentarily forget operating authority related items such as what signal I just had, Form B’s etc.

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... I have to go back and check whether I did a task correctly.

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... I loose track of where I am, what I’ve just done or what I am supposed to be doing at any given moment.

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WAAS Causal Model

- **71%** of employees think about being disciplined ‘often’ or ‘very often’
- **58%** of employees do their duties automatically without thinking about them ‘often’ or ‘very often’
- **46%** of employees reported having near misses ‘sometimes’
A Step Change in Safety Performance

A New Perspective on Employee Responsibility

• The science of attention may explain why some accidents happen...
A Step Change in Safety Performance

A New Perspective on Employee Responsibility

- The science of attention may explain why some accidents happen... *but it’s not an excuse!*

Employees:
- are responsible for their behavior
- are personally accountable to be attentive
- must have highly developed attention skills
- must maintain attentional competency
A Step Change in Safety Performance

A Paradigm Shift for Leaders and Managers

- Workplace Distractions:
  - operational changes, stress, organizational culture, labor/management relations, external influences

- Personal Distractions:
  - Family, financial, health, etc.

- Overload:
  - multitasking beyond capacity, job requirements, work schedules
A Step Change in Safety Performance

A Paradigm Shift for Management (con’t)

- Underutilization:
  - mind wandering/attention lapses

- Routine & Repetitious:
  - “auto pilot” response regardless of current circumstances
Opportunities

• Cognitive sciences are evolving
• Attention skills can be learned
• New considerations for how we lead & manage
• Evolve investigation and root cause analysis
• A new strategic approach to better manage risk and exposure to loss
A Path Forward

• On-going Awareness / Education

• Competency Based Attention Training

• Future Research & Development
  – locomotive simulator analysis
  – cognitive analysis of accident & injury data
  – workplace attention & awareness surveys
  – cognitive interface with new technology (PTC)