



Rail Accident Investigation Branch

# **Investigating human factors in PTI events**

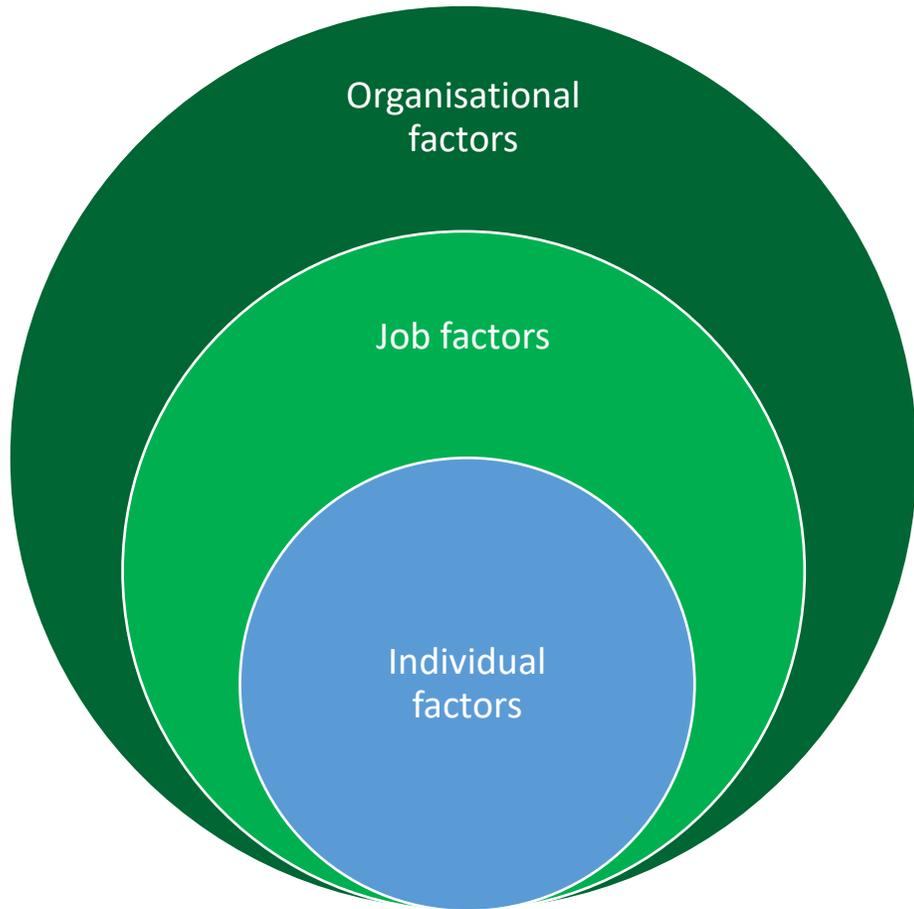
## **Rail Accident Investigators Seminar**

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# Human factors



***‘The scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimise human wellbeing and overall system performance’***

“At first glance, a practice such as closing the train doors would seem an utterly trivial part of the drivers’ duties. Yet, upon deeper examination, this mundane activity can be seen to rely upon a range of skills and artful practices. Drivers draw upon a body of expert practical knowledge regarding passenger behaviour in order to engender and shape human conduct along the crowded platforms. Indeed, the drivers’ ability to close doors effectively and efficiently also has wider organizational import.”

Heath, C. et al *‘interaction in isolation: the dislocated world of the London Underground train driver’*  
Sociology vol 33, issue 3, 3 August 1999

# The accident at Archway station, 18 February 2023



- At approximately 15:51 a passenger (101 years old) became trapped in doors of a Northern line service at Archway station
- The passenger was exiting a rear single leaf door of car 5 when the train doors began to close, and their coat became caught in the closing door
- The passenger was dragged for approximately 2 metres (a companion who was holding the passenger also fell to the ground)
- The train travelled 20 metres before stopping
- The passenger sustained serious injuries

# The accident at Chalk Farm station, 20 April 2023



- At approximately 23:03 a passenger became trapped in the doors of a Northern line service at Chalk Farm station
- The passenger entered the station from the stairs at the end of the platform and attempted to board car 6 of the train but stopped as the door closed
- The passenger's coat became trapped in the doors and the train departed dragging them along the platform
- The train travelled for approximately 20 metres until the coat became free, and the passenger fell to the ground
- The train continued on its journey and the train operator was unaware of the accident
- The passenger sustained minor injuries and psychological distress

# Human factors findings

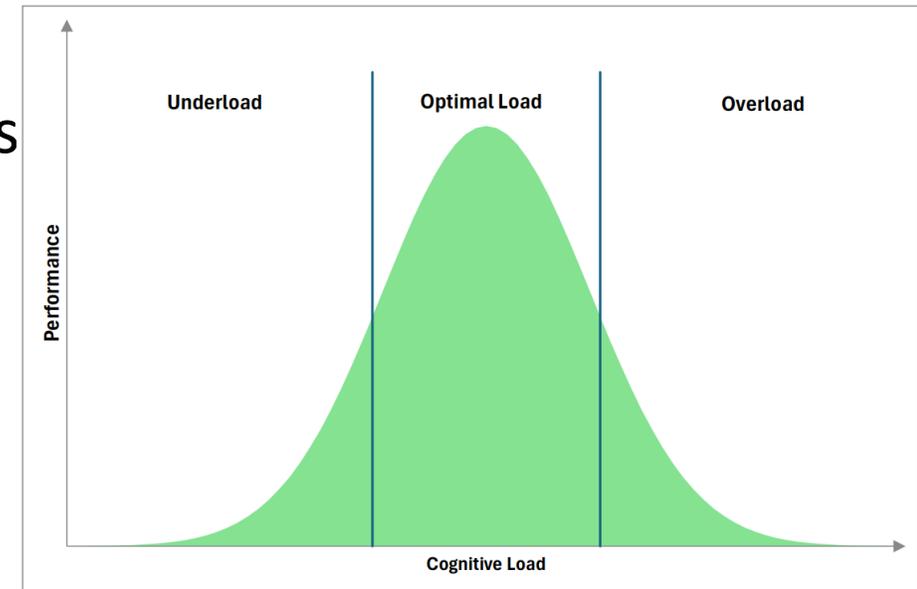
- Automatic train operation and underload
- Reliance on the pilot light
- Pressure to move
- Detecting passengers
- Passenger behaviour

# Automatic train operation and underload

- Trains on the Northern line use ATO as a default mode of operation
- In stations the train operator is responsible for checking CCTV for issues at the PTI, opening and closing doors and initiating the dispatch of the train
- Between stations the train operator's task is monitoring the in-cab displays and looking for obstructions on the line ahead
- At these points the workload is low, and tasks will be repetitive
- This can then result in an automatic mode of responding where attentional resources (the mental capacity for processing information) are withdrawn
- When there is low task related activity, alertness is also reduced, which can result in cognitive underload

# Automatic train operation and underload

- Station stops require a high level of attention and vigilance
- Difficulty can exist due to the switch between levels of activity
- When we experience cognitive underload, our actions become fast (but our attention is reduced and there will be more errors)
- It is not a human failing – it is ‘cognitive economics’ (humans have limited attentional resource)
- Both train operators had spent a lower-than-average time at previous stations immediately before the accidents, suggesting that their actions may have become automatic



# The pilot light

- The train operator involved in the Archway accident was relying on a number of different cues when deciding that it was safe to move the train
- The pilot light indicates that the doors are closed, and that an interlock, which permits the train to be moved has been obtained but it is possible to get this indication with a relatively thin object trapped in the doors due to the limitations of the system
- The train operator did not believe the pilot light would illuminate with something trapped in the doors (oversimplification)
- The importance of not relying on the pilot light/interlock is included in training

# Pressure to move

- Train operators experience interacting goals (departing on time, departing safely) which need to be balanced
- Train operators have target departure times
- Once the wheels stop in the platform the ATO countdown starts.
- When this reaches 11 seconds there is an audible tone and an 'ATO start required' message displayed in the cab
- When the countdown reaches zero, the numbers are displayed in orange and then start counting up
- Although safe despatch is trained and part of procedure, it is possible that the countdown clock may influence the train operators who are conscious of the need to keep the service running to time



# Detecting passengers



# Detecting passengers

- Scanning techniques are trained to train operators
- Scanning the platform is a dynamic task, it is possible that at the point that a check of the platform is made a passenger who is close to the train may not be visible and may be obscured by other passengers on the platform
- Train operators must make decisions about passengers boarding and alighting multiple times on every shift. They often experience people standing close to the train or getting things trapped in the doors
- Higher event rates can produce a loss in vigilance performance, so the more PTI near misses they experience, the greater the risk that their vigilance might actually decrease



via Campi 11  
11/11/2023



# Detecting passengers

- The size and contrast of an object will affect whether it is detected or not
- A reconstruction of the accident at Chalk Farm showed that it was difficult to identify a person in the same position that the passenger was in
- The passenger would have appeared small in the in-cab monitor and there was low contrast
- Although the CCTV systems are checked regularly and maintained there are no checks to assess image quality holistically, such as reviewing what a train operator reports they can subjectively see on the in-cab CCTV monitor

# Passenger behaviour

- The passenger at Chalk Farm believed that the doors would reopen to release their coat
- Research has shown (RSSB T1102) that 58% of rail passengers believe that the doors will reopen automatically if an obstruction is detected

*‘Two-thirds of passengers interviewed did not understand the door close alarm as indicating that they should ‘stand back’. Instead, passengers tend to disregard the alarm and continue to board, which shows that the meaning of hustle alarms is not well understood by passengers’*

Get on/off 41%

Stand back 33%

Doors closing 26%

***“Nobody comes to work to do a bad job. People do what makes sense to them at the time given their focus of attention, their knowledge and their goals.” (Sydney Dekker)***

Thank you

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