Moving Map Displays: Using CTIL and Eye Tracking Technologies to Measure Operator Glance Durations and Performance in Locomotive Cabs

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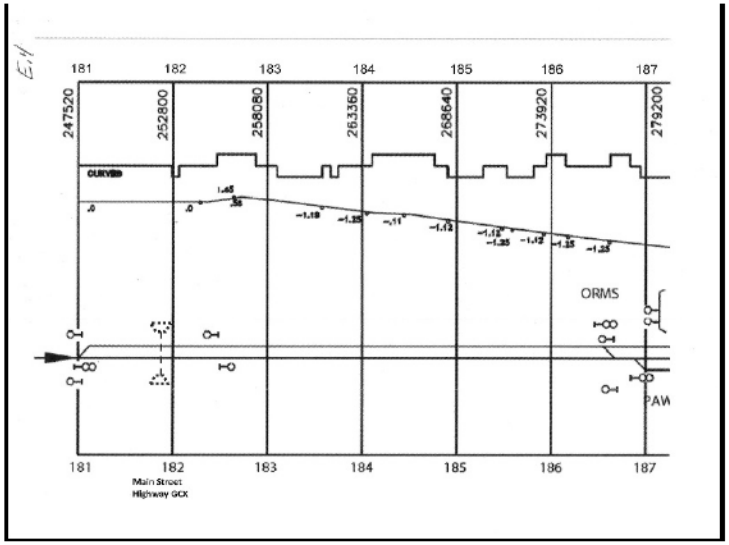
Outline

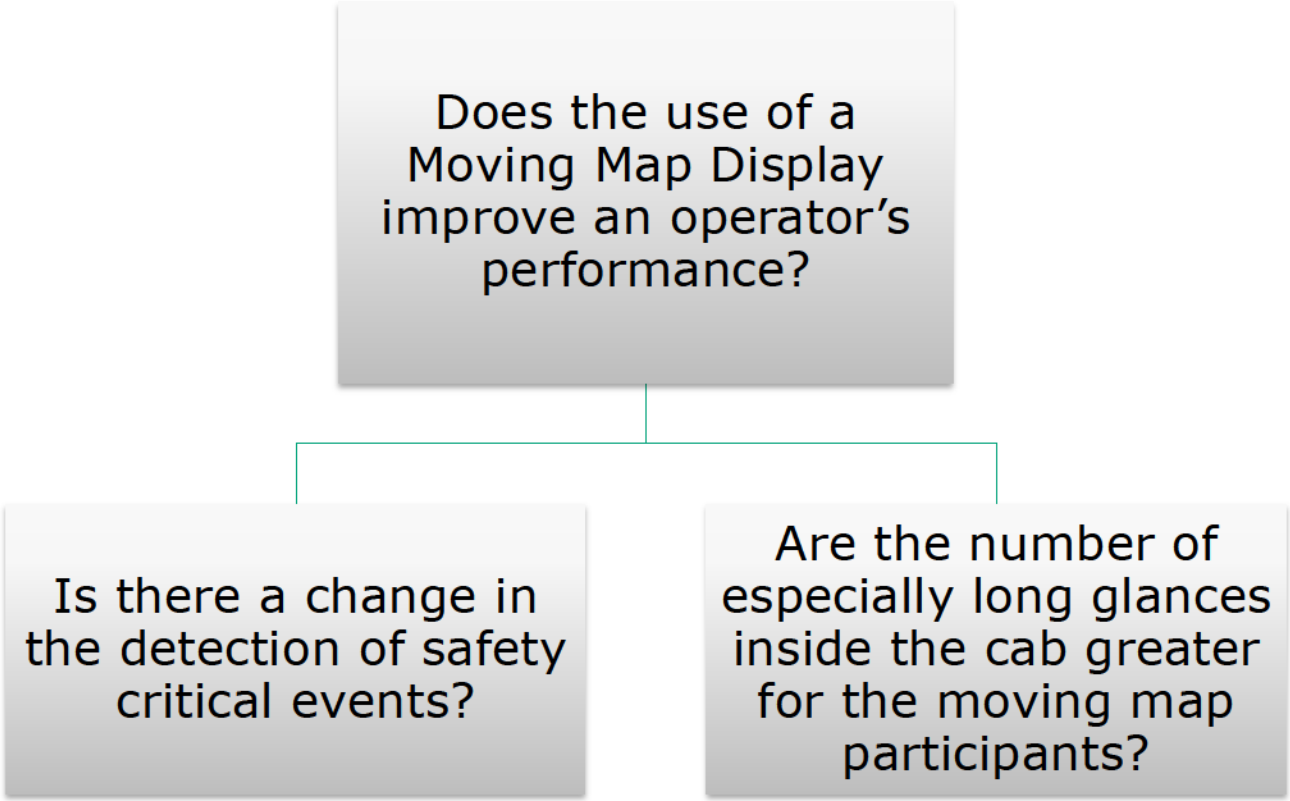
- Motivation
- Objective
  - Hypothesis
  - Dependent variables
- Experimental Design
- Results
  - Engineer Performance
  - Eye Tracking Results
- Discussion

Motivation

What is the Moving Map Display?



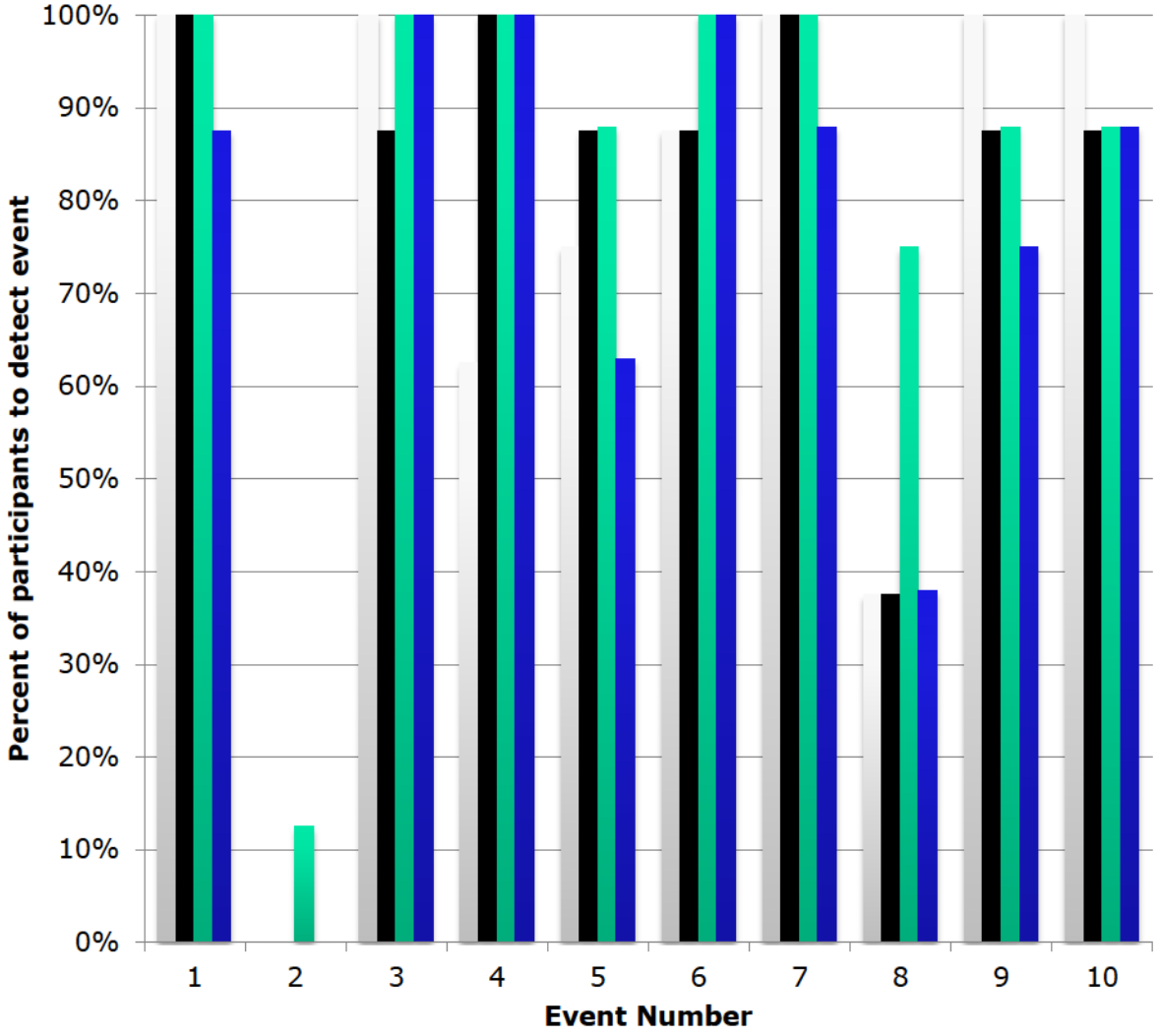
The Research Questions



Scenario Description

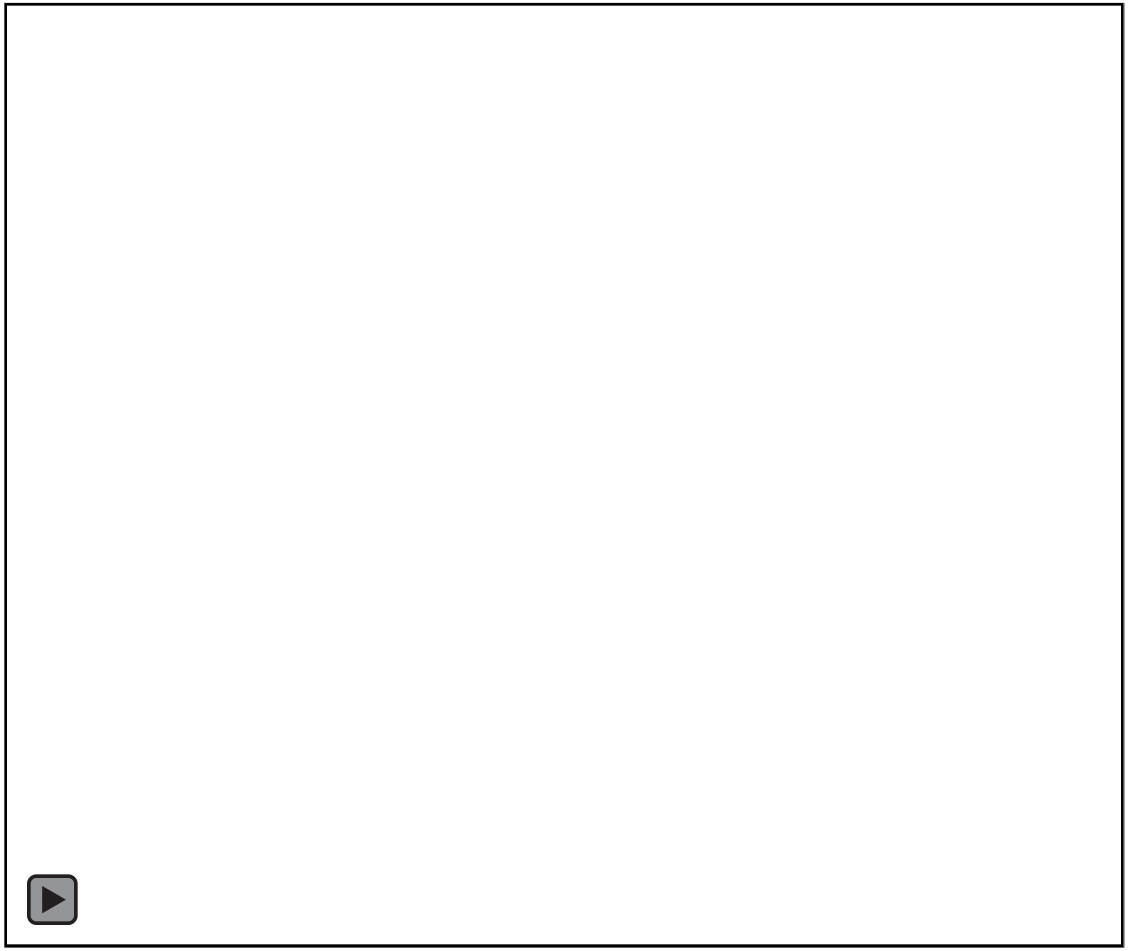
- 10 Safety Critical Events
  - 2 Work Zones
  - 2 Quiet Zones
  - 1 Hot Box Detector Malfunction
  - 1 Vehicle on the Track
  - 1 Stop and Protect Order
  - 1 Bridge Strike Order
  - 1 Trespasser on the Track
  - 1 Signal Malfunction

Scenario Description



Event Number
1 - Work Area Gonzales
2 - HBD Malfunction
3 - Work Area Jones
4 - Vehicle In Row
5 - Stop and Protect
6 - Bridge Strike
7 - Trespasser in Row
8 - Signal Drop
9 - Quiet Zone
10 - Quiet Zone

Tracking points of interest with Asl eye tracker



How much time is spent looking inside the cab?

Moving Map

Average Total Run Time	3948.93 Seconds
Average Total time looking in cab over 2 seconds	443.07 seconds
Proportion of time looking inside the cab over 2 second	0.1122

Paper Map

Average Total Run Time	3,704.18 seconds
Average Total time looking in cab over 2 seconds	537.477 seconds
Proportion of time looking inside the cab over 2 second	0.1451

How much time is spent looking inside the cab?

Moving Map

Average Total number of glances	550
Average Total number of glances over 2 seconds	142
Proportion of glances inside the cab over 2 seconds	0.258

Paper Map

Average Total number of glances	517
Average Total number of glances over 2 seconds	142
Proportion of glances inside the cab over 2 seconds	0.275

Discussion

- Limitations
  - None of the participants were qualified for the route given
  - Sample size is too small to generalize across the entire population of Commuter Rail Engineers

- Future Work
  - Redesign the Moving Map based on Engineer feedback to make it more efficient
  - Look at the effects of providing a moving map to the conductor who currently doesn't even have a paper map.

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