



Transportation Research Symposium 2025

Driver Distraction Analysis: A Big-Data Analytics Approach Using Naturalistic Driving Data

Ajay Iyer¹, Mohammad Pashae¹, Eleonora Papadimitriou¹,
Amir Pooyan Afghari¹, Pieter Van Gelder¹

¹ Faculty of Technology, Policy, and Management, Delft University of
Technology, Delft, Netherlands



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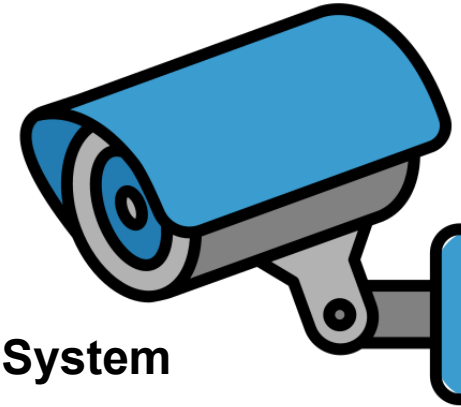
Introduction



1.19 million people (2023)



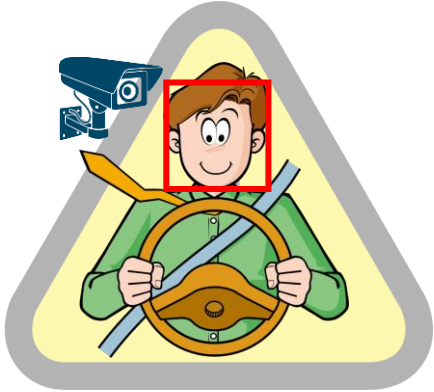
Driver distraction is a major contributing factor



Driver Monitoring System



Introduction



- Policy and Privacy Concerns
- Technological Constraints
- Unequal Access
- Limited Consideration of Global Behavior



Descriptive Analysis

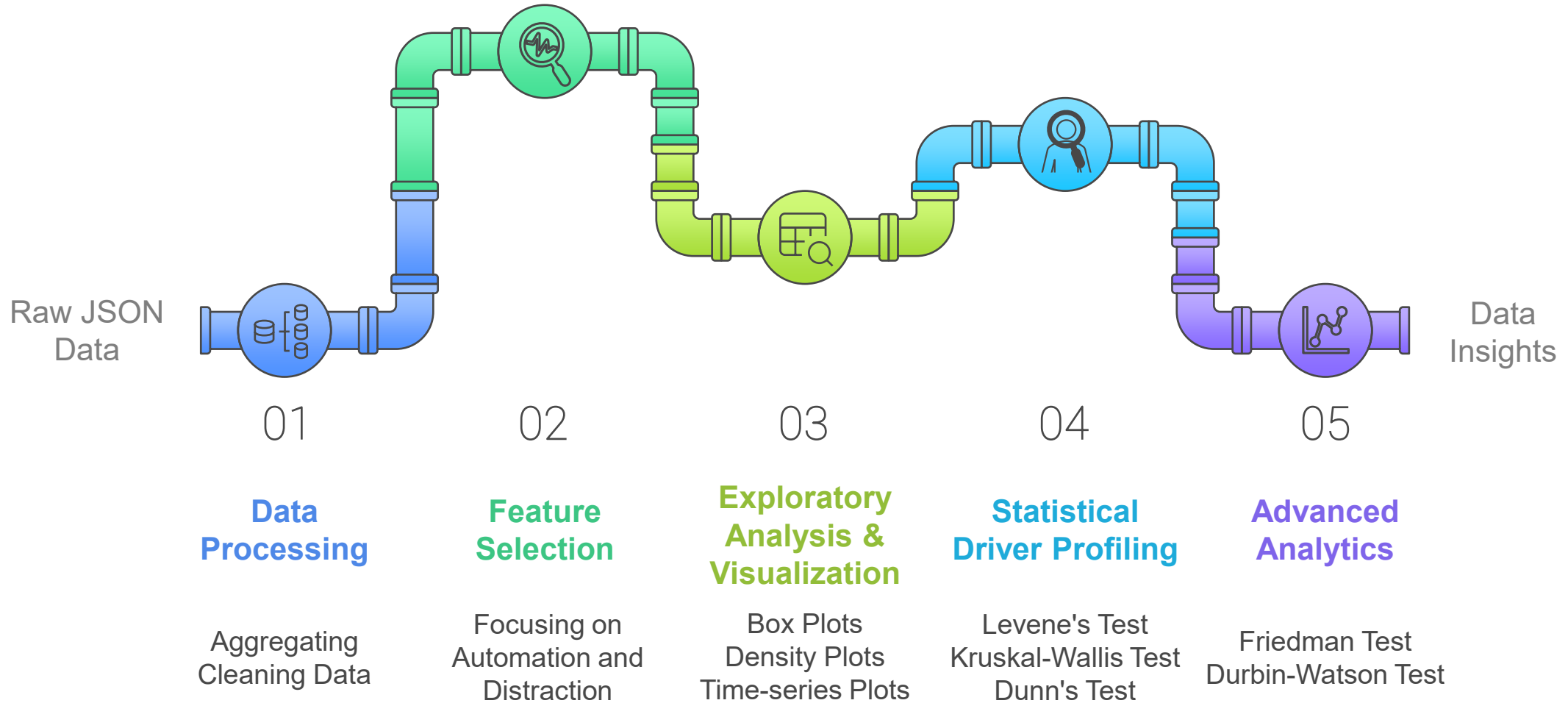


- To explore and describe how **self-reported driver distraction** is associated with **driving behavior**, and **levels of automation**
- Inform and improve **future driver monitoring systems**



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Methodology

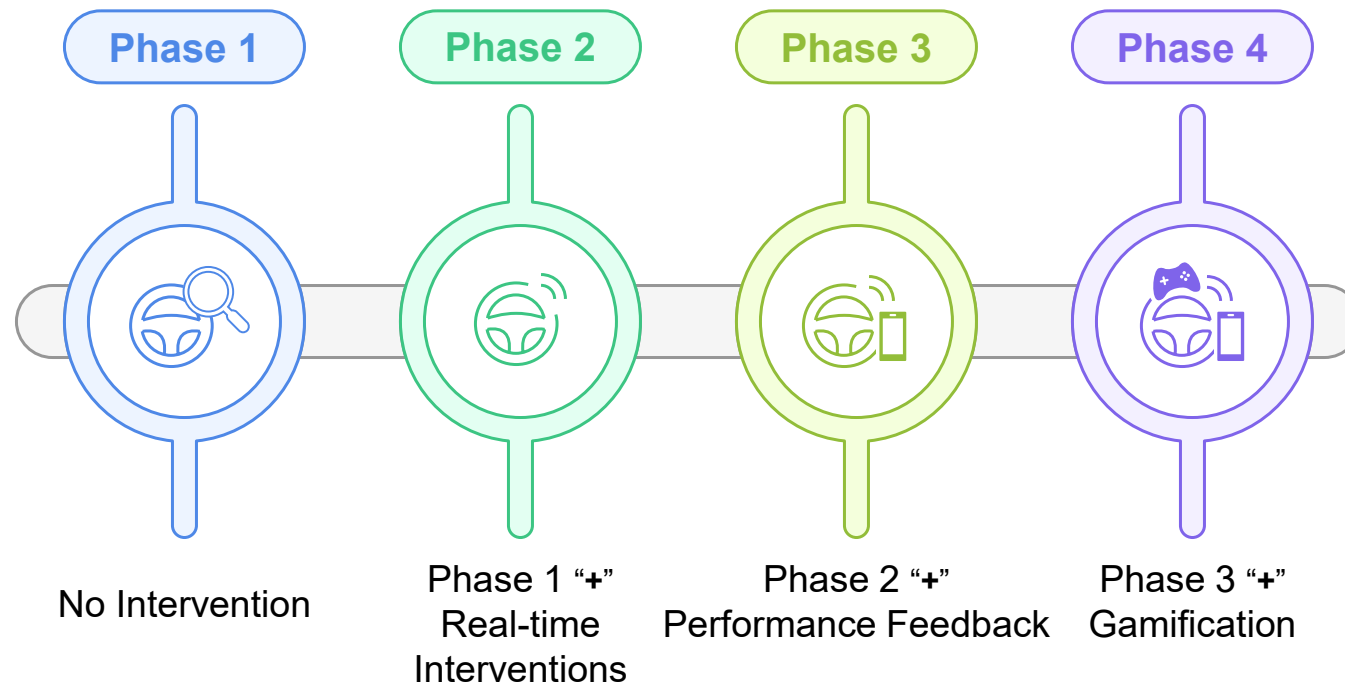


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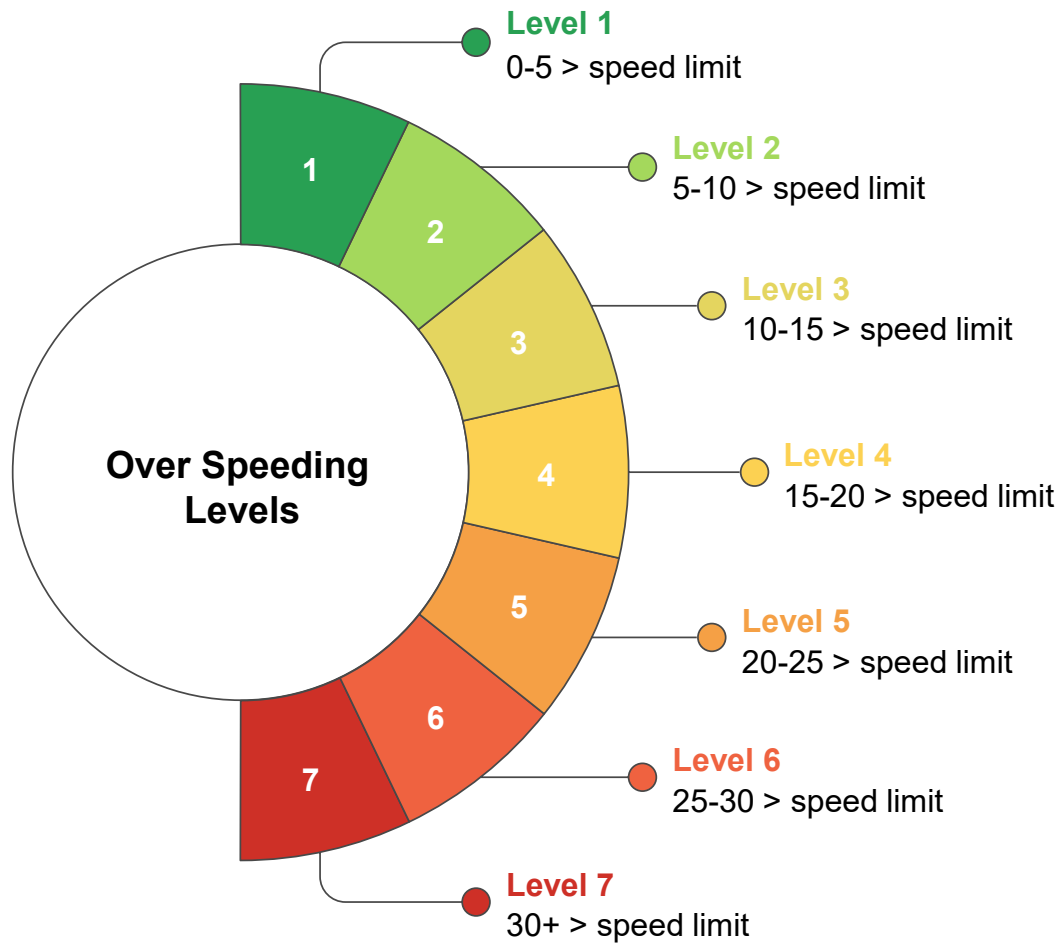
Dataset



➤ Define, Develop, Test and Validate a 'Safety Tolerance Zone'



Dataset



Harsh Events



Harsh Braking



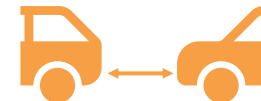
Harsh Accelerating



Harsh Cornering

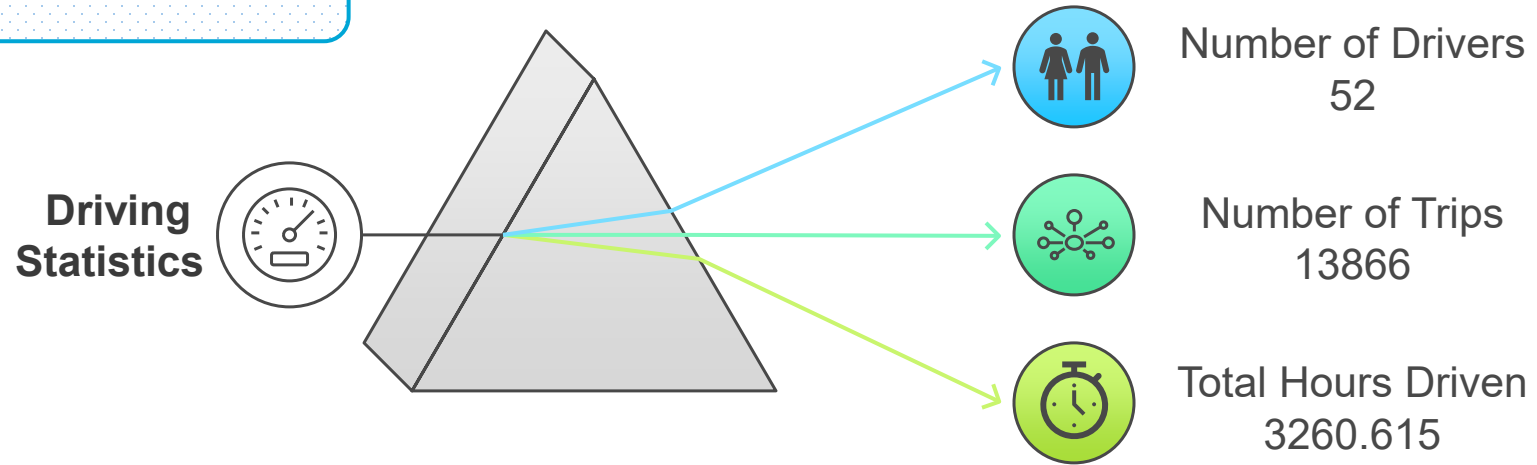


Over Speeding

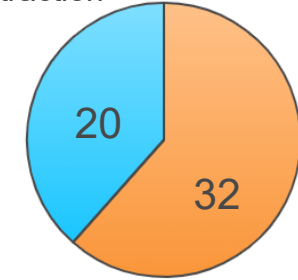


Risky Headway

Dataset

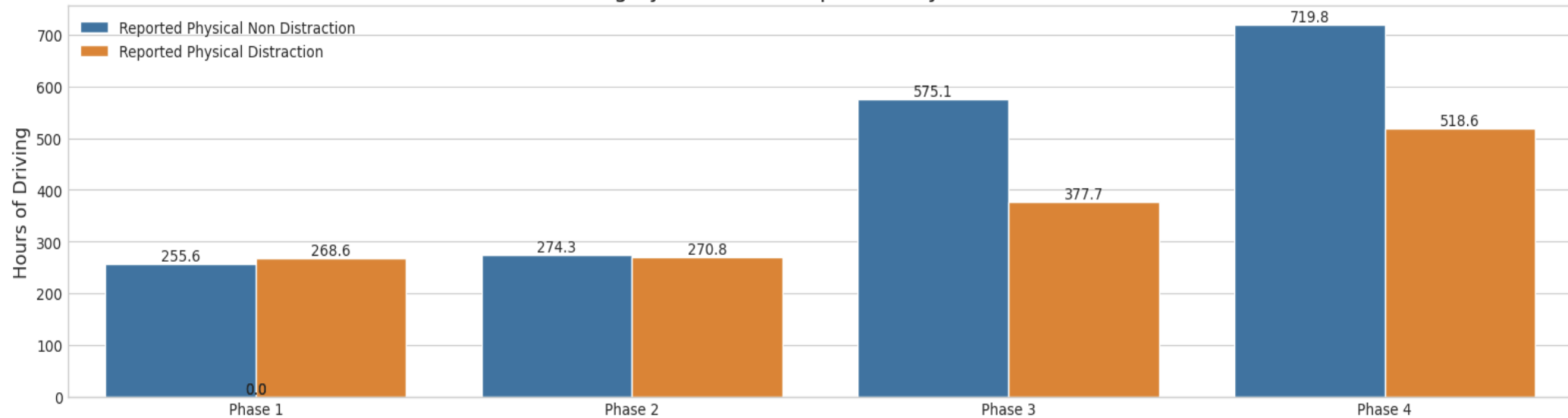


Reported Physical Distraction



Reported Physical Non-Distraction

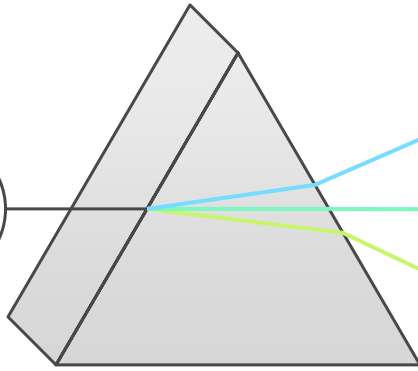
Hours of Driving by Phase and Reported Physical distraction Status



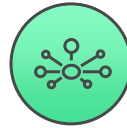
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Dataset

Driving Statistics



Number of Drivers
52

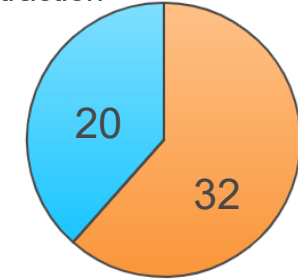


Number of Trips
13866

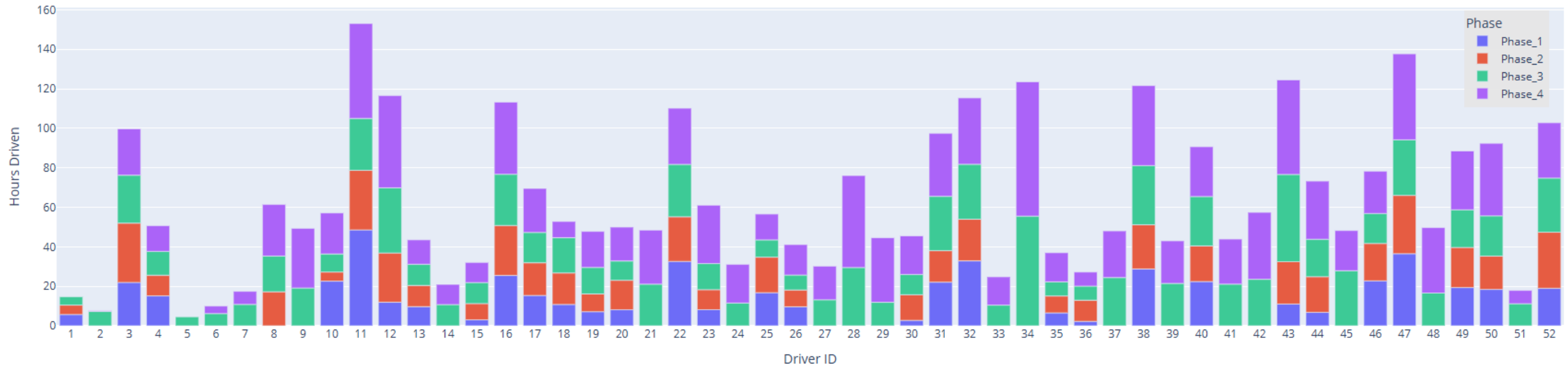


Total Hours Driven
3260.615

Reported Physical Distraction



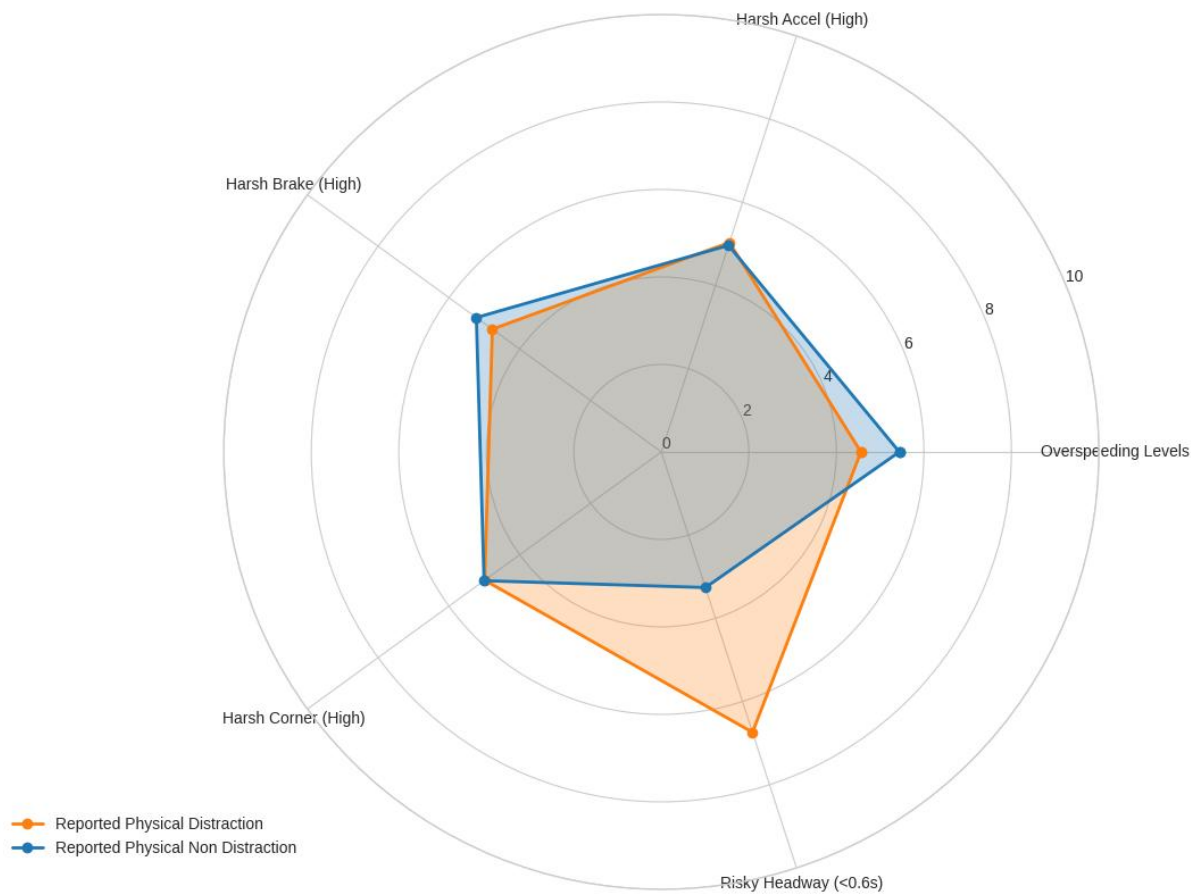
Reported Physical
Non-Distraction



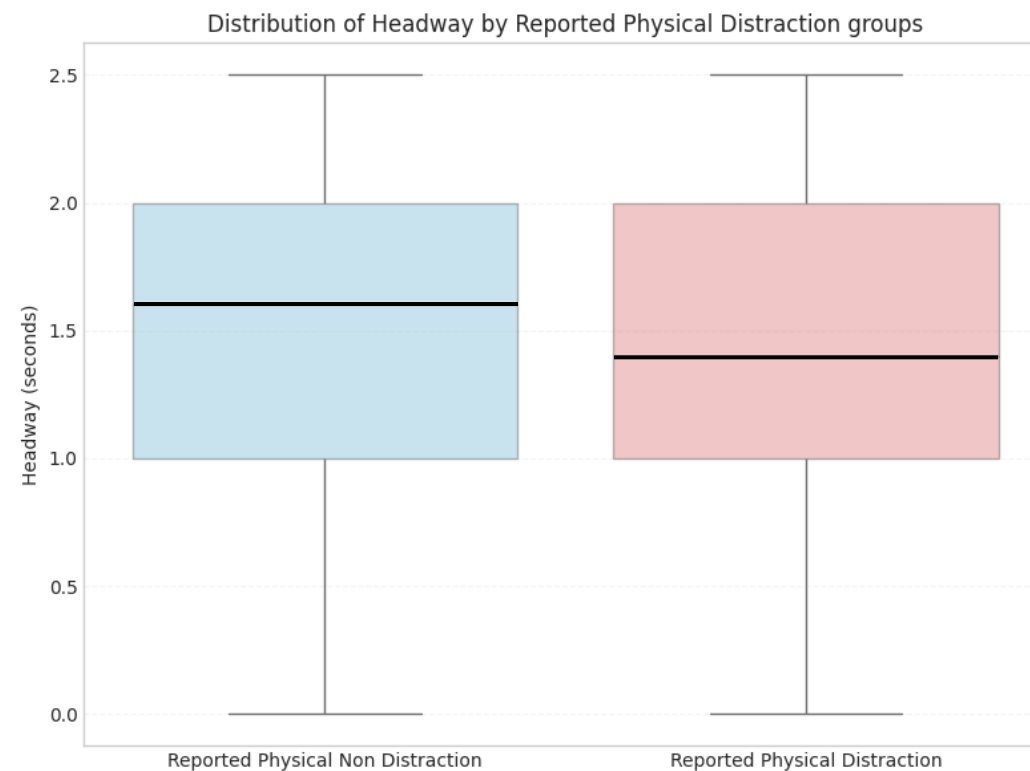
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Behavior Analysis

Comparative Radar Chart of Driving Behavior by Reported Physical distraction Groups



❖ Distracted drivers tend to show more “Risky Headway”



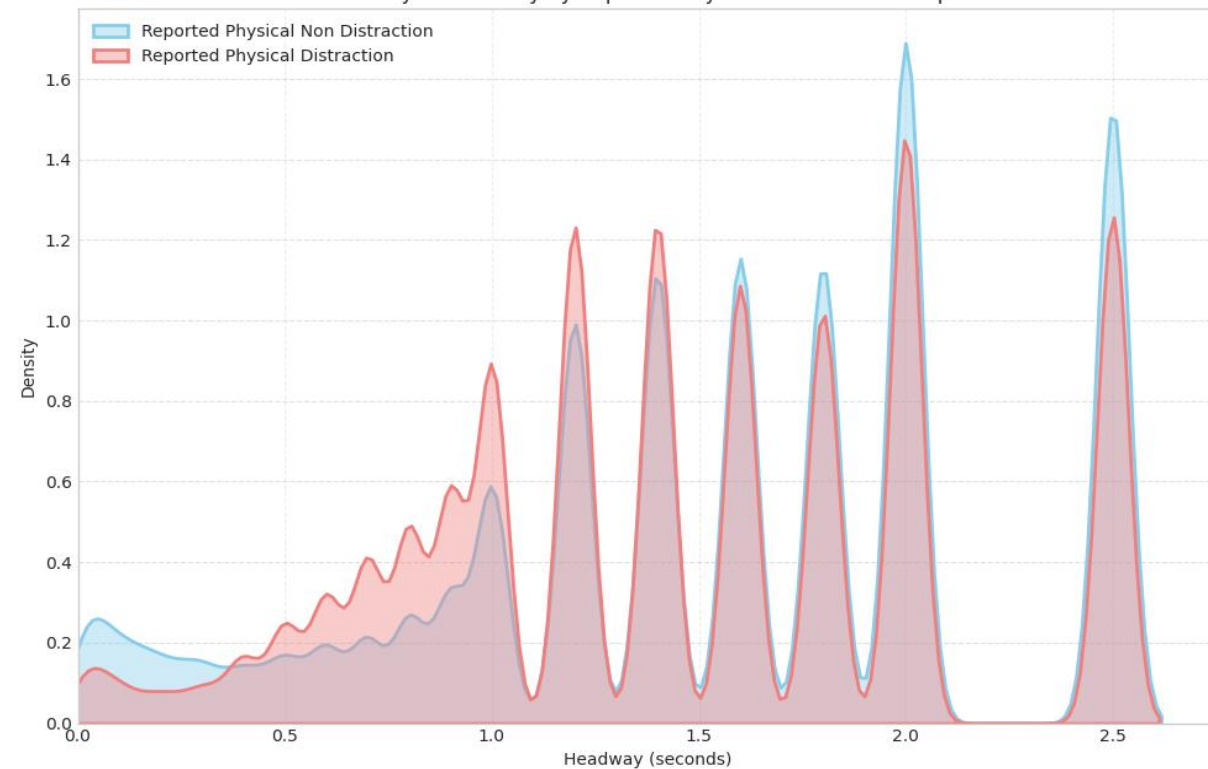
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Behavior Analysis

Comparative Radar Chart of Driving Behavior by Reported Physical distraction Groups



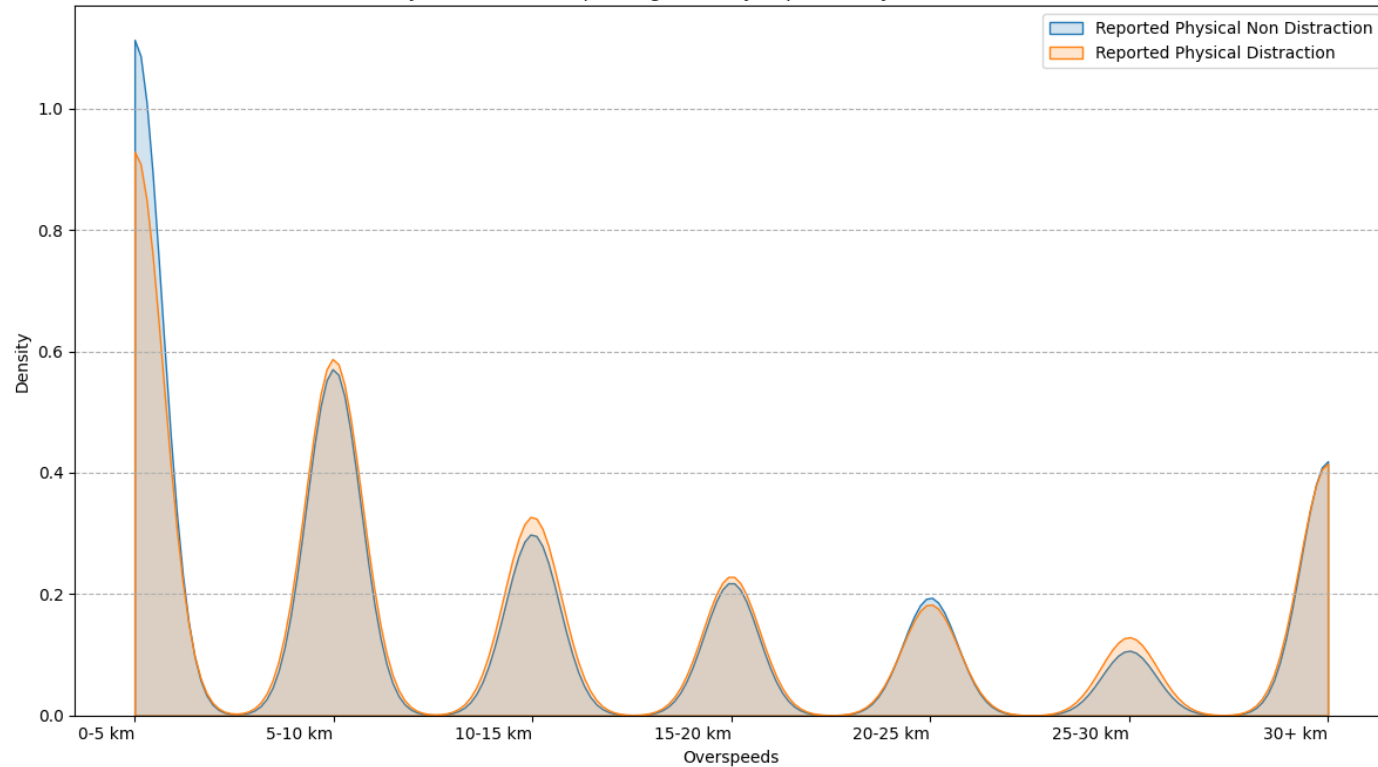
Density of Headway by Reported Physical Distraction Groups



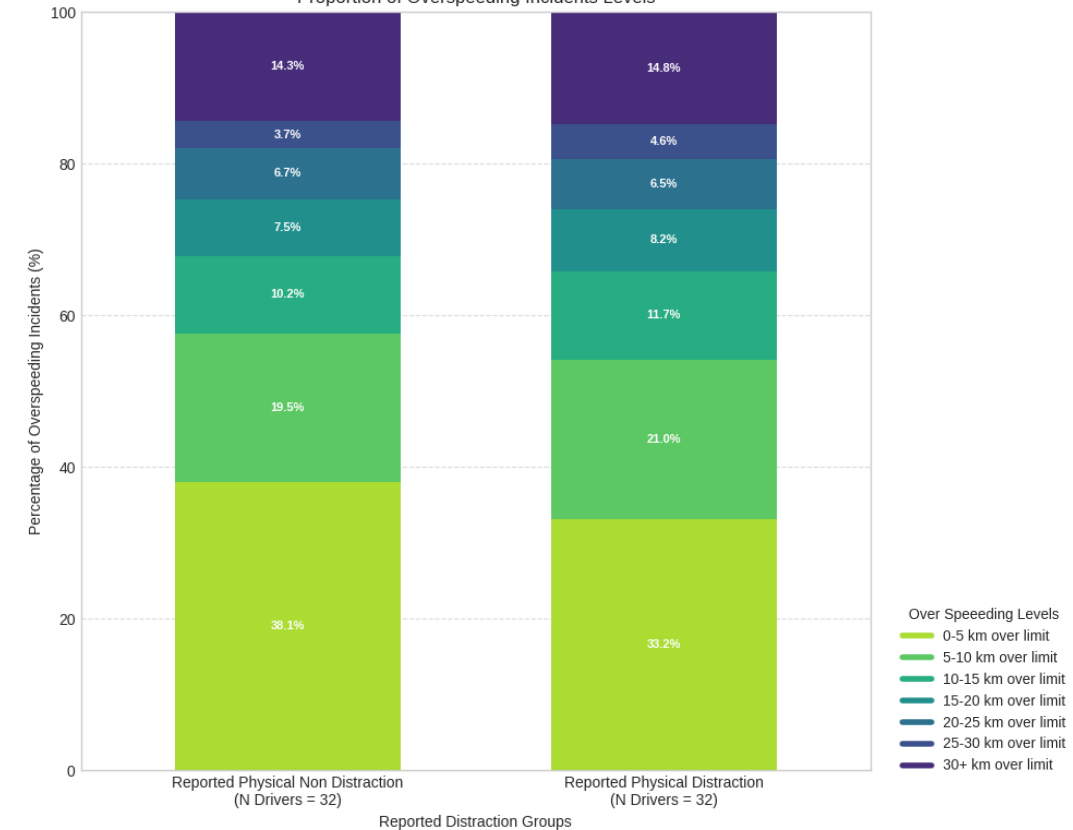
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Behavior Analysis

Density of Active Over Speeding levels by Reported Physical Distraction Status



Proportion of Overspeeding Incidents Levels

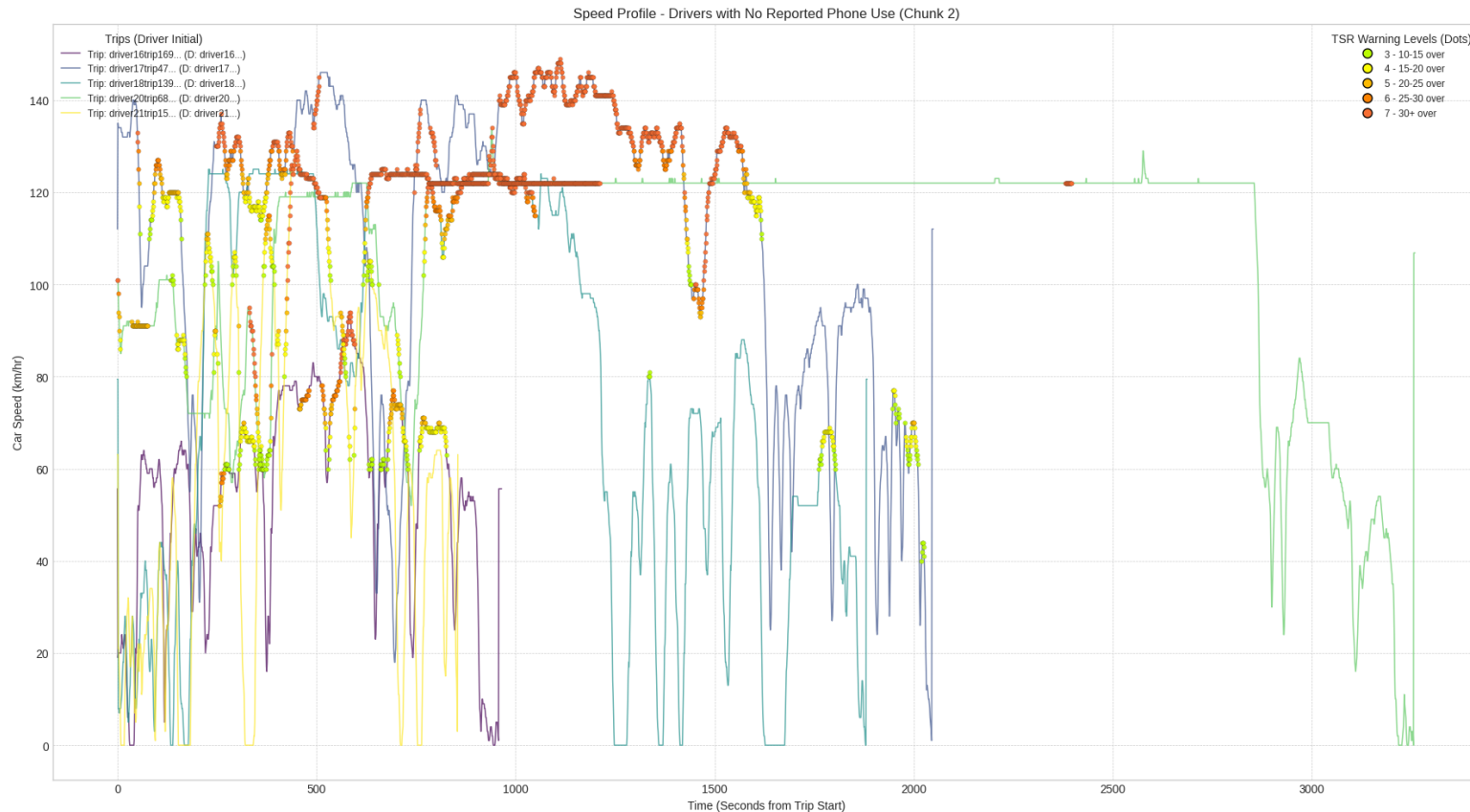


❖ Higher speeds deviations for reported distraction group



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Behavior Analysis



- Durbin-Watson Test for Headway

- Drivers in all 4 phases = 30
- $DW < 2$: Positive autocorrelation

DW Statistic	
Phase 1	0.026
Phase 2	0.026
Phase 3	0.023
Phase 4	0.024
Avg. Stat. Across All Drivers	0.029

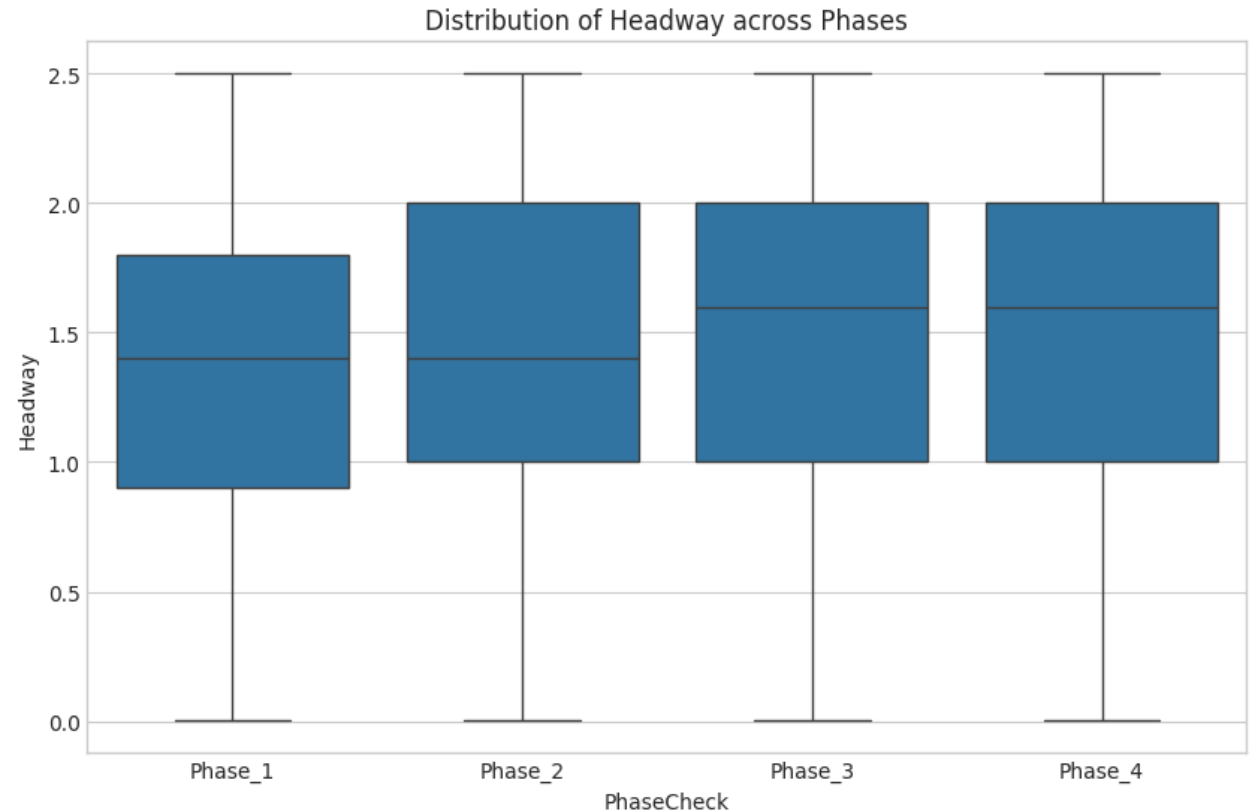


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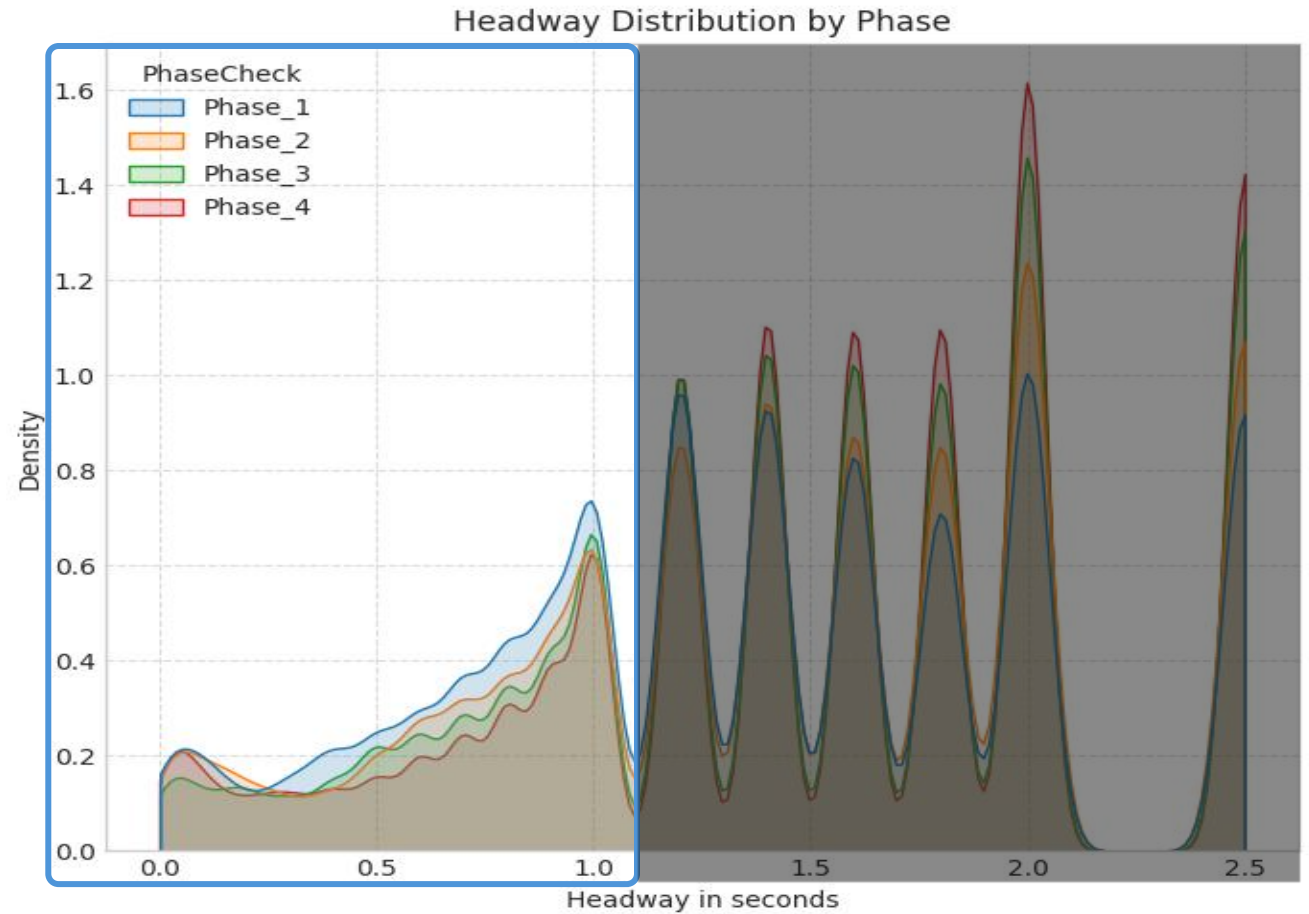
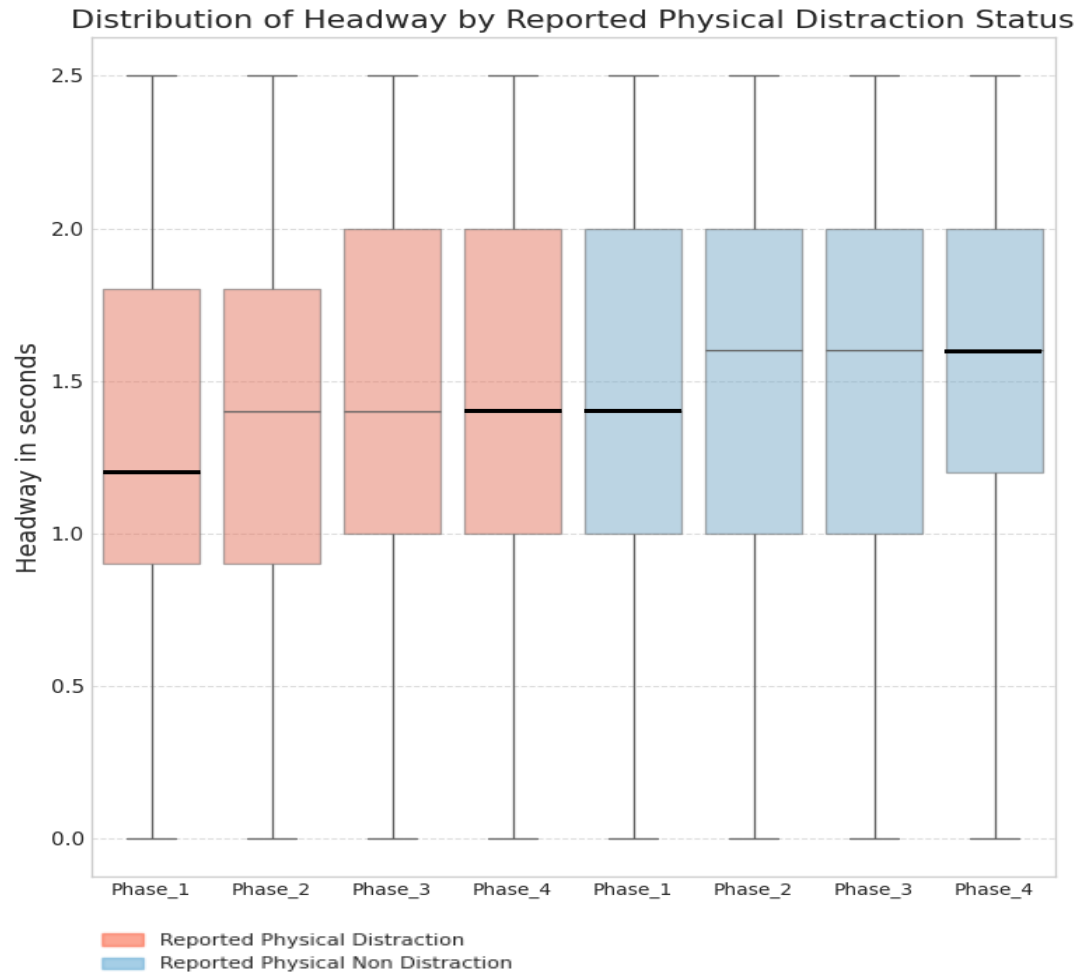
Different Automation Level Analysis

- Friedman Test for Headway
 - Drivers in all 4 phases = 30
- p-values:

	Phase 1	Phase 2	Phase 3	Phase 4
Phase 1	1.000	0.626	0.034	0.00004
Phase 2		1.000	0.437	0.005
Phase 3			1.000	0.273
Phase 4				1.000



Different Automation Level Analysis



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Summary



Big-Data Analytics



- **Reported Distraction & Headway:** A complex relationship between driver headway and their reported distraction
- **Speeding Behavior:** Reported distraction group shows greater tendency to exceed speed limits
- **Consistent Patterns:** Positive temporal correlation in over-speeding behavior across all drivers and automation phases
- **Effective Interventions:** Driver automation and behavioral interventions (gamification) show positive impact on driver headway maintenance

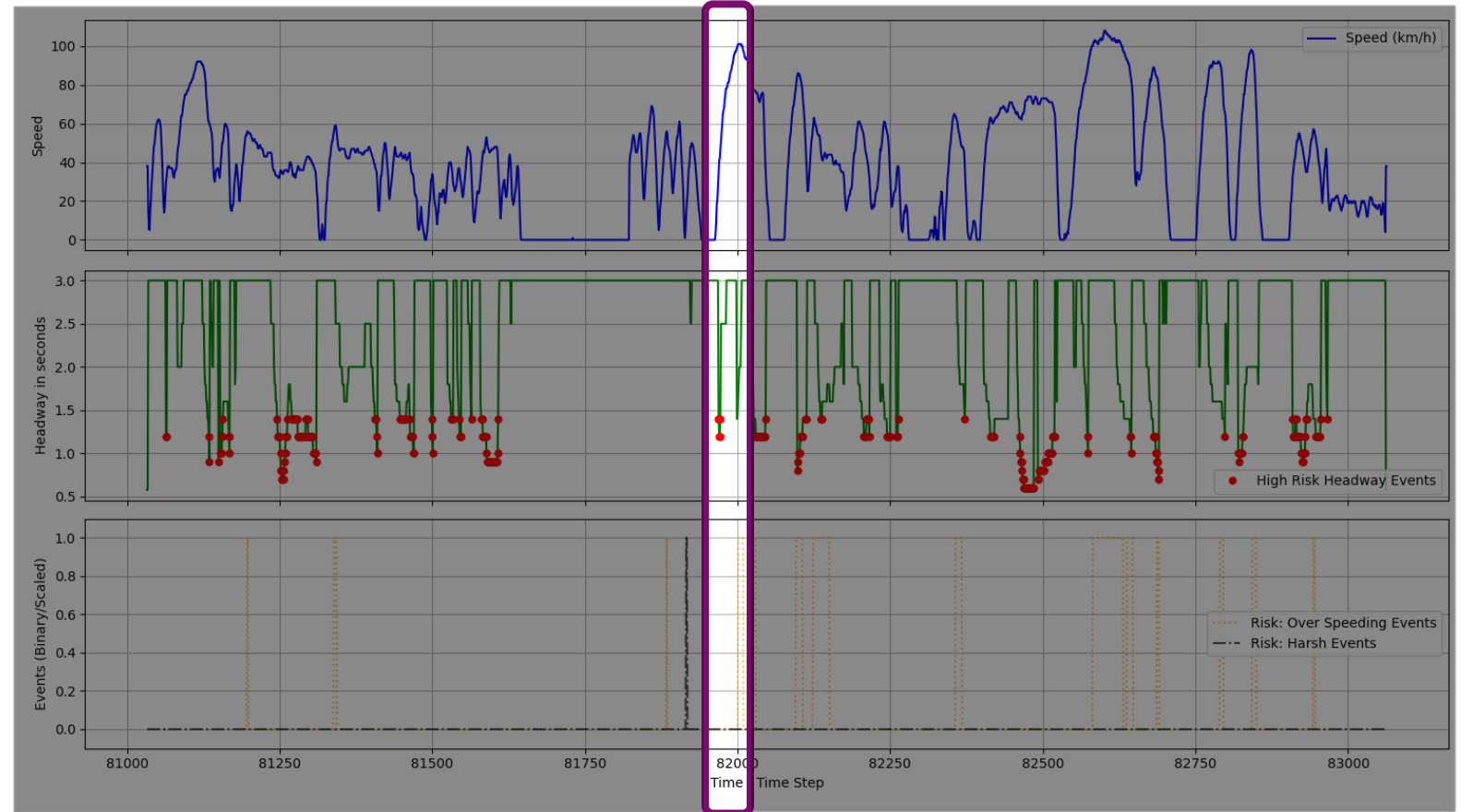
Limitation & Future Works



- Data Constraints
- Self-Report Bias



- More Dataset (e.g. Sharp2)
- More Parameters (e.g. IBI)
- Real-time Data on Distraction
- Closer Look (Per Trip)



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**"Multitasking: the ability to
screw everything up simultaneously."**

- Jeremy Clarkson

