Driver Profiles of Visual Manual Phone Engagement and The Contexts in Which They Occur

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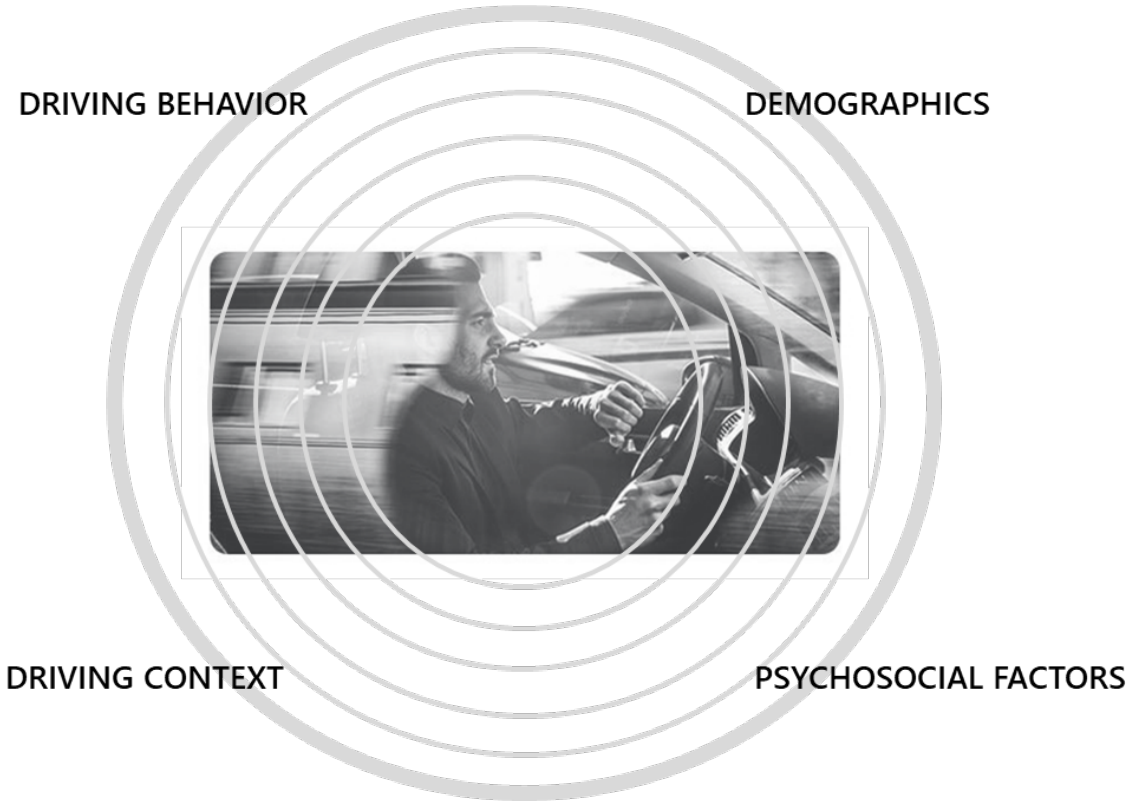
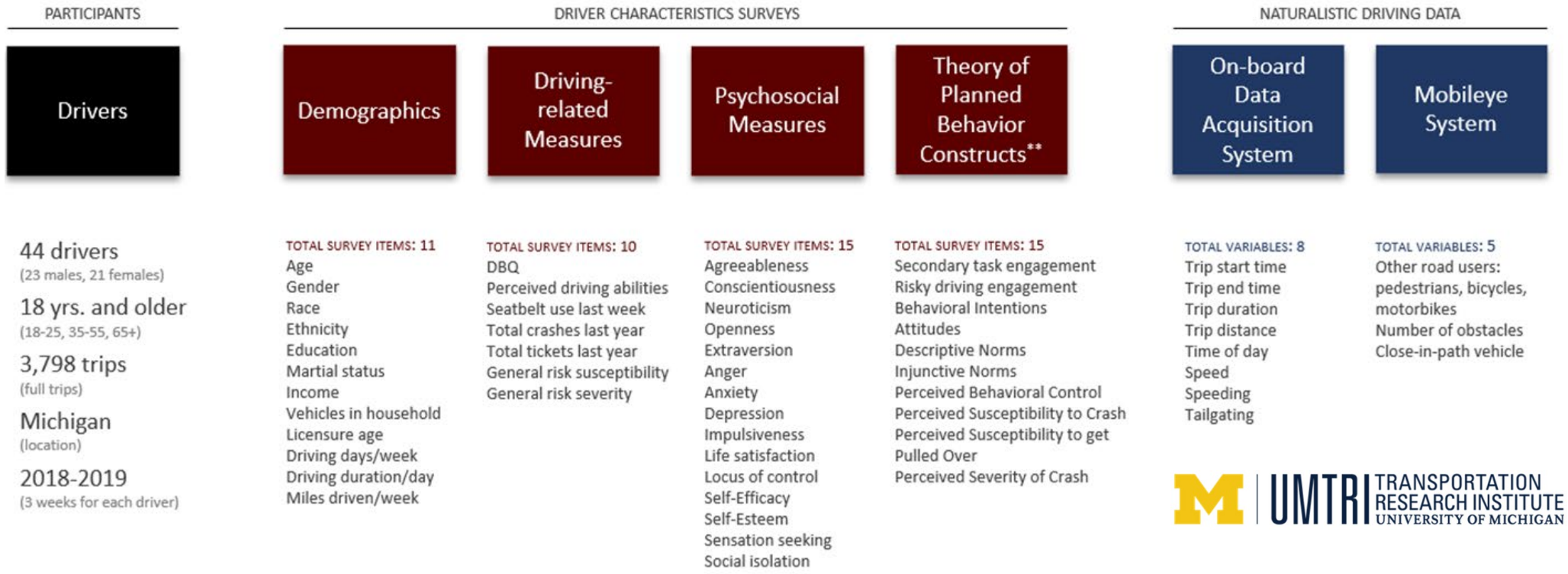
What's left to know about visual-manual phone engagement (VMPE)?

- Many existing studies focus on phone engagement "events"
- Holistic approach to establishing predictors of phone engagement
- Understanding the motivations for phone engagement may help identify more effective countermeasures to reduce it

- Goal: Identify trip- and individual-level features that predict VMPE and allow us to categorize driver dispositions



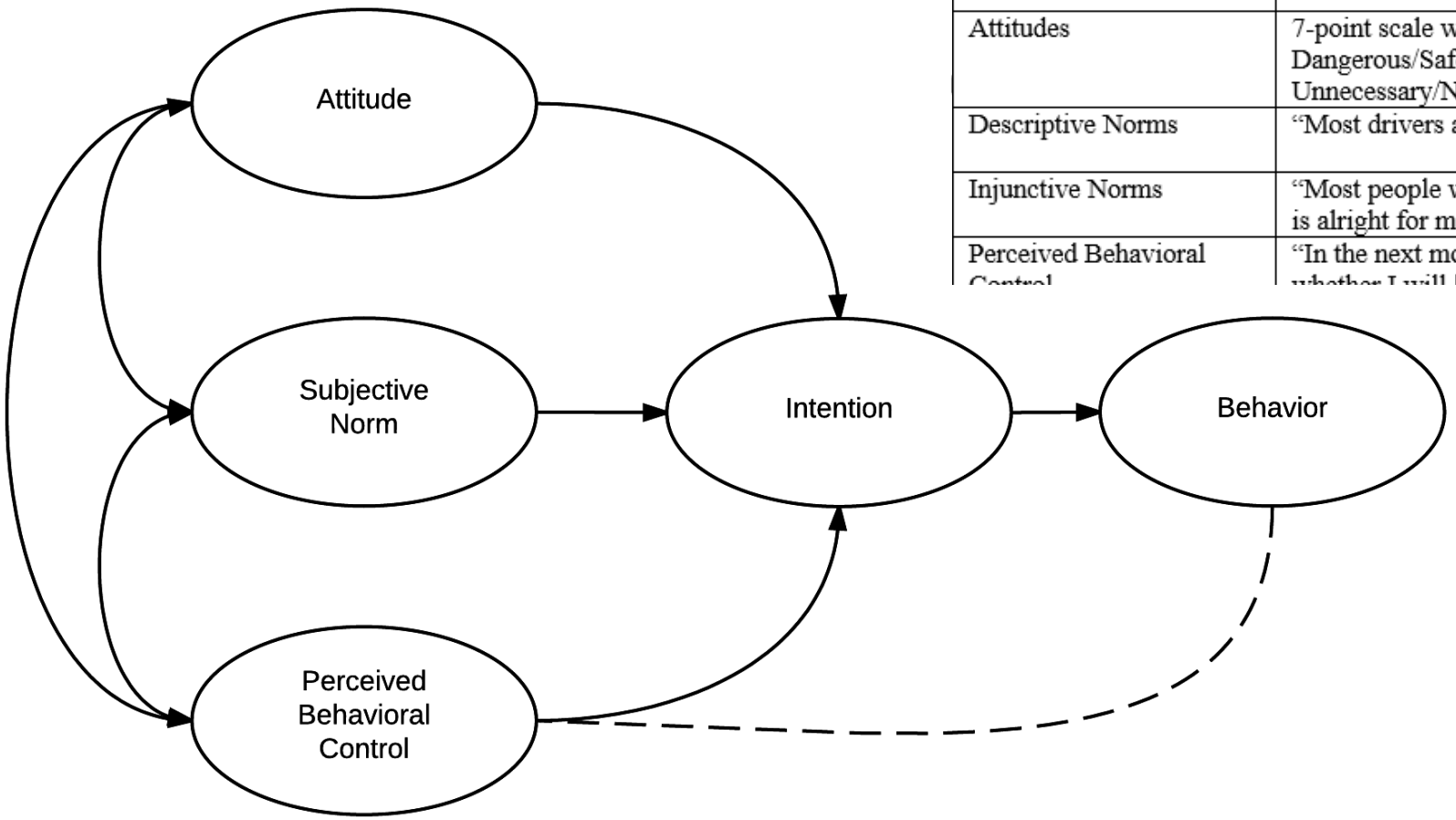
Risky driving dataset created by UMTRI and CSRC



Characteristics

- Coded visual-manual phone engagement: hand-held texting/ browsing, and dialing hand-held
- 558 full trips contains 7,087 instances of phone engagement / 1349 sequences
- Holistic approach that includes vehicle, driver, and contextual data
- Includes time from trip start to trip end with human annotation

Theory of planned behavior in questionnaires



Instrument	Example
Behavioral Intentions	"While driving in the next month, how likely is it that you will [behavior]?"
Attitudes	7-point scale word pairs: Bad/Good, Dangerous/Safe, Unpleasant/Pleasant, Unnecessary/Necessary, Unwise/Wise
Descriptive Norms	"Most drivers around me [behavior]"
Injunctive Norms	"Most people who are important to me think it is alright for me to [behavior]"
Perceived Behavioral Control	"In the next month, it is mostly up to me whether I will [behavior]"

Research questions

2021

What driving behavior, contextual, demographic, and psychosocial variables are associated with risky driving behaviors?

UMTRI TRANSPORTATION RESEARCH INSTITUTE UNIVERSITY OF MICHIGAN

Molnar, L. J., Eby, D. W., Zakrajsek, J. S., Kostyniuk, L. P., Zanier, N., LeBlanc, D. J., & Sayer, T. (2021). Guidelines for Development of Evidence-Based Countermeasures for Risky Driving-Final Technical Report, Volume 2.

2023

Can we derive new variable relationships that enable us to predict the likelihood of VMPE?

TOUCHSTONE EVALUATIONS INC.

The Comprehensive Driver Profile Framework

- New analysis techniques
- Predict VMPE ahead of time

Key findings preview

2023

Can we derive new variable relationships that enable us to predict the likelihood of VMPE?

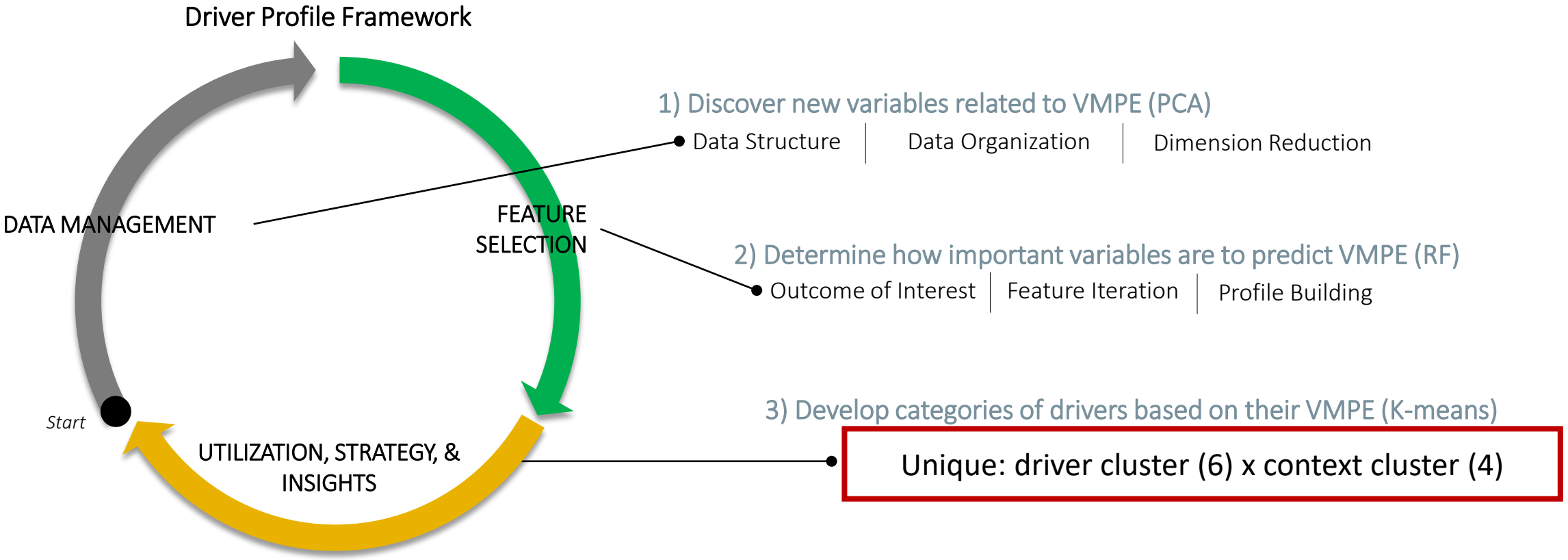
The Comprehensive Driver Profile Framework

- New analysis techniques
- Predict VMPE ahead of time

- Results showed that the strongest predictor of VMPE onset was the interaction between driving context and drivers' attitudes and norms toward VMPE
  - Idling and surrounding vehicle speeds
  - Attitudes toward phone use
- VMPE driver profiles revealed three types: Consistent Context-Independent VMPE, Selective Context-Specific VMPE, and Minimal VMPE

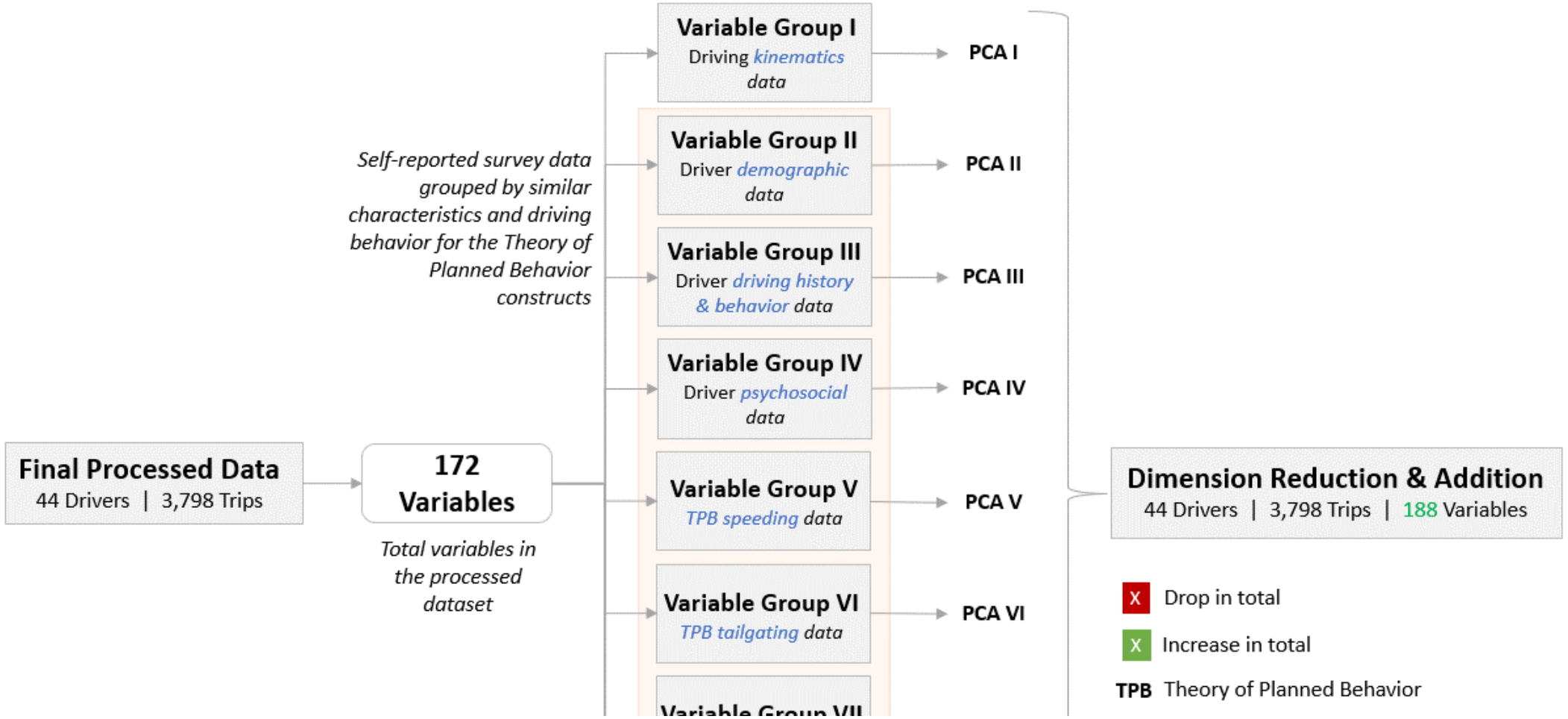
Comprehensive Driver Profile (CDP) Framework[1]

Applying machine learning techniques that have not traditionally been used to analyze VMPE data with the goal of explaining driver behaviors and motivations



Ref: [1]Payyanadan, R. P., & Angell, L. S. (2022). A framework for building comprehensive driver profiles. Information, 13(2), 61.

Example feature selection: PCAs were conducted on construct groupings to preserve interpretability



Random Forest predictors 2 seconds ahead of engagement included both driving context and driver attitudes (76% accuracy)

Types of predictors

- Traffic-related situations
- Time of travel on certain roads
- Positive attitudes toward risk
- Willingness and intent to engage in risk

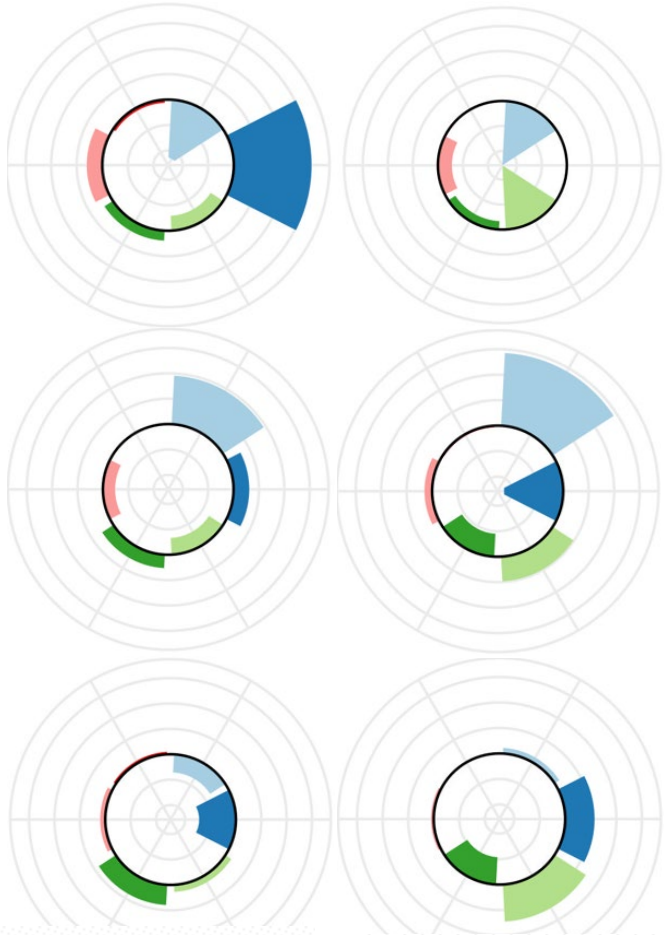
MAIN EFFECTS	
Predictors	**Effect Size** (% effect on mean VM phone engagement onset)
Low % of trip spent idling *6 seconds ago*	20.1%
Positive attitude toward NDRT engagement *pc* (TPB NDRT)	12.4%
Morning drives on secondary, residential roads with little to no traffic *pc*	13.5%
Speeding is safe, pleasant, high perceived susceptibility to be pulled over speeding, others do not think it is okay to speed *pc* (TPB Speeding)	56%
Positive attitudes toward phone engagement *pc* (TPB Phone)	35.3%
High sensation seeking, low self-esteem *pc* (TPB Psychosocial)	20.5%
Morning trip start time	17.2%
Intend to speed, low past speeding behavior *pc* (TPB Speeding)	3.6%
Surrounding vehicle speed (stopped) *12 seconds ago*	42.1%
High sensation seeking, low self-efficacy *pc* (TPB Psychosocial)	15.8%

Drivers were clustered based on the attitudinal and norm predictors that achieved high importance

CLUSTER 1
- Favourable views on speeding
- Plan to speed
- Positive attitudes toward phone use while driving

CLUSTER 2
- Favourable views on NDRT engagement
- Positive attitudes toward speeding and phone use while driving

CLUSTER 3
- Positive attitudes toward phone use while driving
- Unfavourable views on speeding



CLUSTER 4
- Low sensation seekers and NDRT engagers
- Negative attitudes toward speeding, NDRT, and phone use

CLUSTER 5
- Favourable views on NDRT engagement
- Negative attitudes toward speeding and phone use while driving
- High sensation seekers

CLUSTER 6
- Favourable views on speeding
- Higher sensation seekers
- Negative attitudes toward speeding and phone use while driving

Contexts were clustered based on the traffic and time predictors that achieved high importance

Consistent drivers engaged often in the morning or evening

CLUSTER 1
- Favourable views on **speeding**
- Plan to **speed**
- Positive attitudes toward phone use while driving

CLUSTER 2
- Favourable views on NDRT engagement
- Positive attitudes toward speeding and phone use while driving

CLUSTER 3
- Positive attitudes toward **phone use** while driving
- Unfavourable views on speeding

CLUSTER 4
- Negative attitudes on speeding, NDRT, and phone use
- Low **sensation seekers**

CLUSTER 5
- Favourable views on NDRT engagement
- Negative attitudes toward speeding and phone use while driving
- High sensation seekers

CLUSTER 6
- Favourable views on **speeding**
- Higher **sensation seekers**
- Negative attitudes toward speeding and phone use while driving

	CLUSTER 1	**CLUSTER 2**	CLUSTER 3	CLUSTER 4	**CLUSTER 5**	CLUSTER 6
Total drivers	4	**8**	11	5	**5**	11
% time driving	9%	**20%**	28%	12%	**10%**	21%
Age (average)	55 yrs.	**36 yrs.**	40 yrs.	43 yrs.	**49 yrs.**	60 yrs.
Most like to occur in the context of	High % of trip spent idling, high number of stopped surrounding vehicles	**Morning drives, early trip start time**	Low % of trip spent idling, late trip start	Morning drives, and early trip start times	**Low % of trip spent idling, late trip start time**	High % of trip spent idling, high number of stopped surrounding vehicles
% idling with this context	67.2%	**15.7%**	13.2%	15.7%	**13.2%**	67.2%

Selective appear sensitive to contexts or trip goals

CLUSTER 1
- Favourable views on **speeding**
- Plan to **speed**
- Positive attitudes toward phone use while driving

CLUSTER 2
- Favourable views on **NDRT engagement**
- Positive attitudes toward speeding and phone use while driving

CLUSTER 3
- Positive attitudes toward **phone use** while driving
- Unfavourable views on speeding

CLUSTER 4
- Negative attitudes on speeding, NDRT, and phone use
- Low **sensation seekers**

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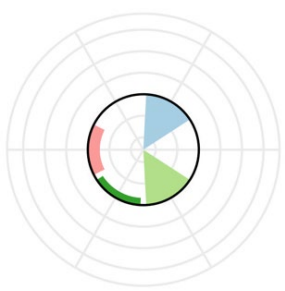
Averse try to avoid VMPE unless it is needed based on the context

CLUSTER 1
- Favourable views on **speeding**
- Plan to **speed**
- Positive attitudes toward phone use while driving

CLUSTER 2
- Favourable views on **NDRT engagement**
- Positive attitudes toward speeding and phone use while driving

CLUSTER 3
- Positive attitudes toward **phone use** while driving
- Unfavourable views on speeding



CLUSTER 4
- Negative attitudes on speeding, NDRT, and phone use
- Low **sensation seekers**

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- Favourable views on **NDRT engagement**
- Negative attitudes toward speeding and phone use while driving
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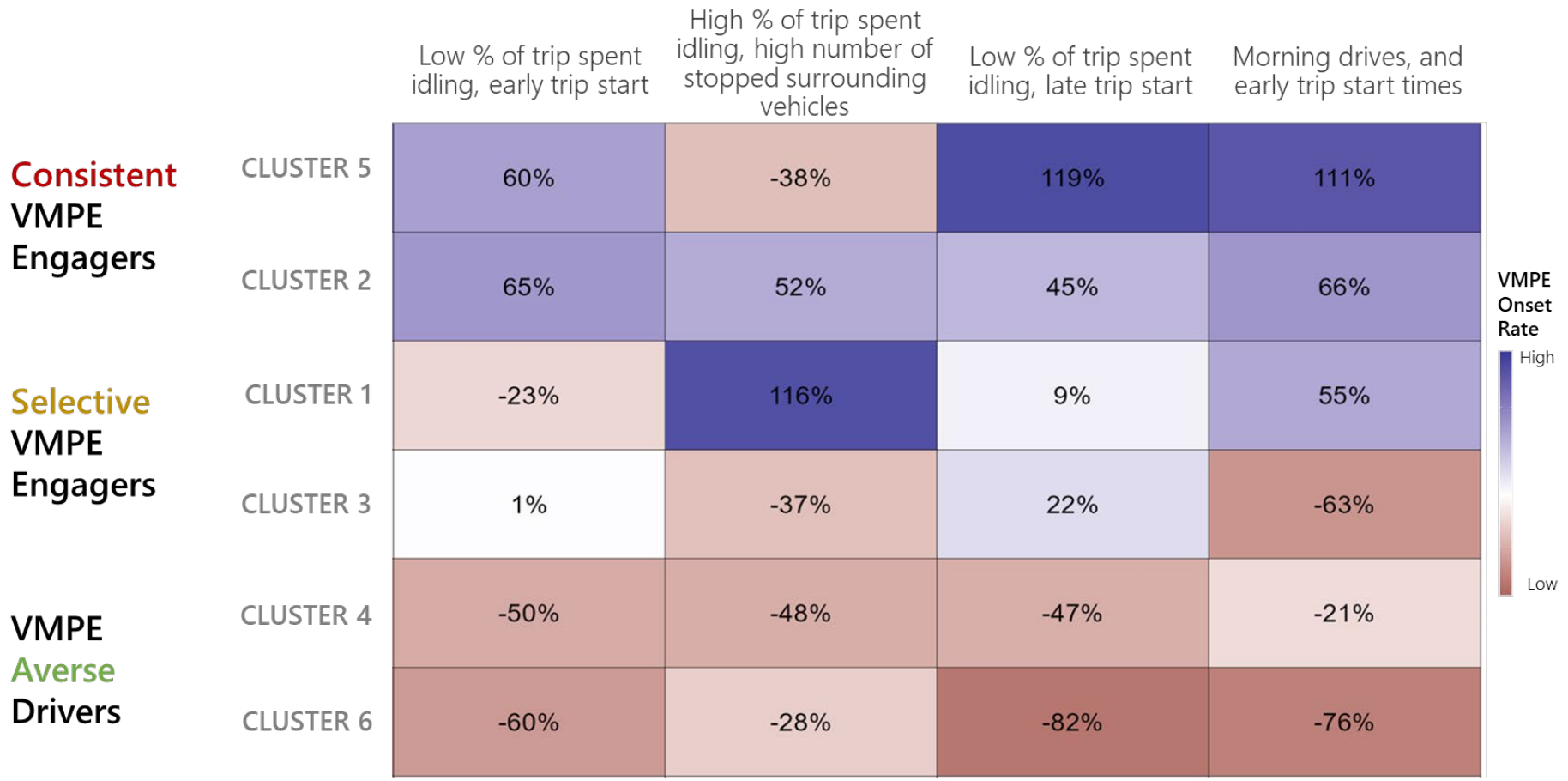
% idling with this context	67.2%	15.7%	13.2%	**15.7%**	13.2%	**67.2%**

Conclusions

- Context was distributed across all 6 driver clusters; the interaction between the drivers are contexts revealed key differences
- Counterintuitively VMPE was more frequent in situations with less idling
- Consistent, Selective, and Averse driver categories may warrant different countermeasures

Thank you!



Google Scholar

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