CHALMERS
UNIVERSITY OF TECHNOLOGY

A method for identifying aggressive driving by using naturalistic driving data

Jordanka Kovaceva, Chalmers University Of Technology, Sweden
Irene Isaksson Hellman, If P&C Insurance, Sweden

7th International Symposium on Naturalistic Driving Research, Blacksburg, USA, 28-29 August 2018

Agenda

- Aim
- Data
- Method
- Results
- Conclusions

Aim

- Identify metrics that can categorize driver behavior associated with higher crash risk
- Aggressive driving in car-following situations
- Investigate effects of drivers characteristics on the identified metrics

UDRIVE

EUROPEAN NATURALISTIC DRIVING STUDY

NUMBER OF DRIVERS PER COUNTRY:

87871 HOURS OF DATA COLLECTED

VEHICLE TYPES:	🚚	🚗	🏍️
NUMBER OF DRIVERS:	48	186	47
HOURS OF DATA COLLECTED PER VEHICLE:	41389	45591	891

NUMBER OF DRIVERS 281
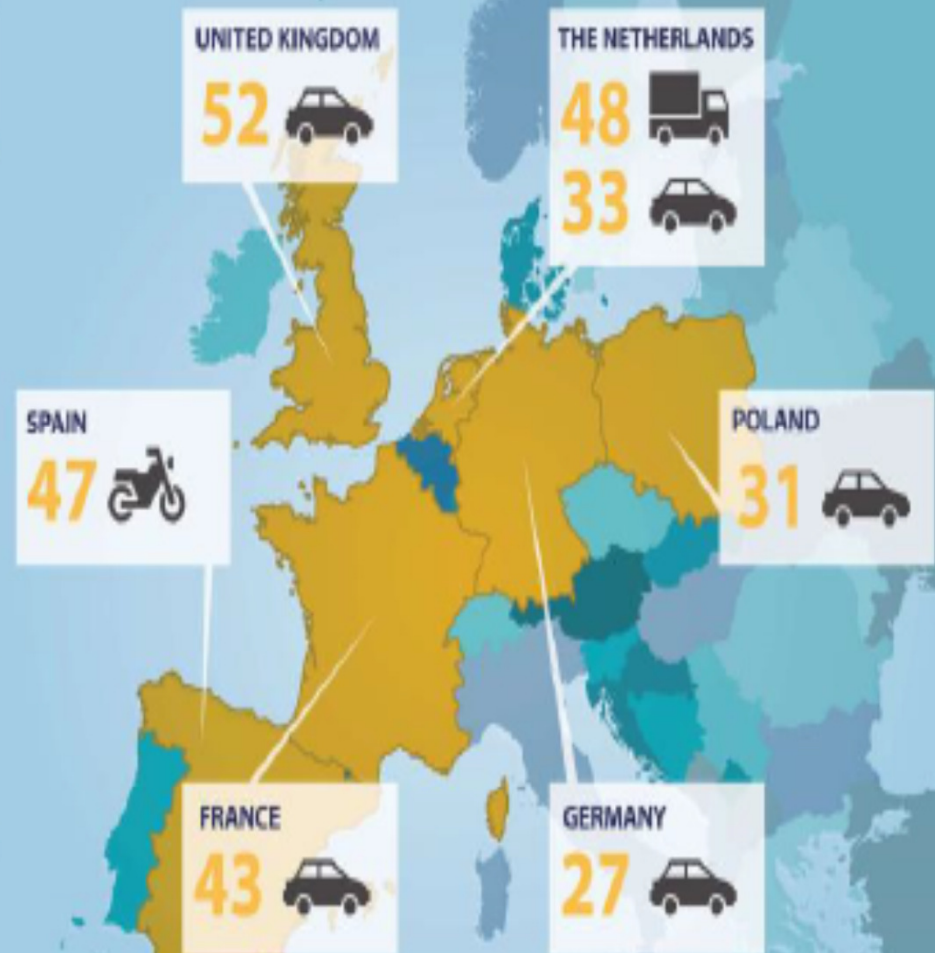
UNITED KINGDOM 52 🚗

THE NETHERLANDS 48 🚚 33 🚗

SPAIN 47 🏍️

POLAND 31 🚗

FRANCE 43 🚗

GERMANY 27 🚗

UDRIVE

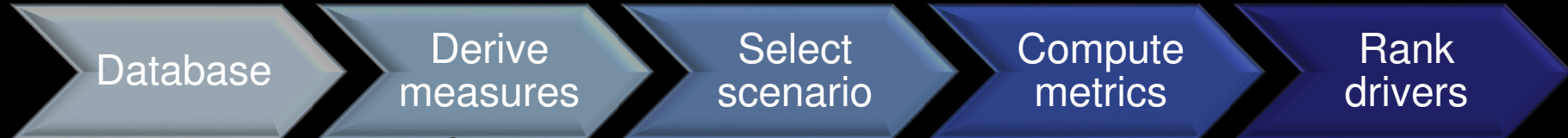European Naturalistic Driving Study

Questionaries' data

- Driver Behaviour Questionaries' (DBQ)
  - 19 items assessing the prevalence of errors and violations in the driver's everyday behaviors
  - High score = more reported aggressive driving violations
- Arnett Inventory of Sensation Seeking (AISS)
  - 20 items assessing the risk-taking and sensation-seeking nature of a driver's personality
  - High score = drivers seek out highly novel or high intensity experiences

Lajunen et. al (2004); Arnett (1994)

Method

-Vehicle sensor (V, a)
-Mobile eye (range)
-Map data (road type)

V > 40km/h   THW < 4 s

-Motorway
-No CC

Top 25%

Database → Derive measures → Select scenario → Compute metrics → Rank drivers

-Longitudinal jerk
-THW

$$\% \; tailgating = \frac{THW < 0.4s}{THW < 4s} * 100$$
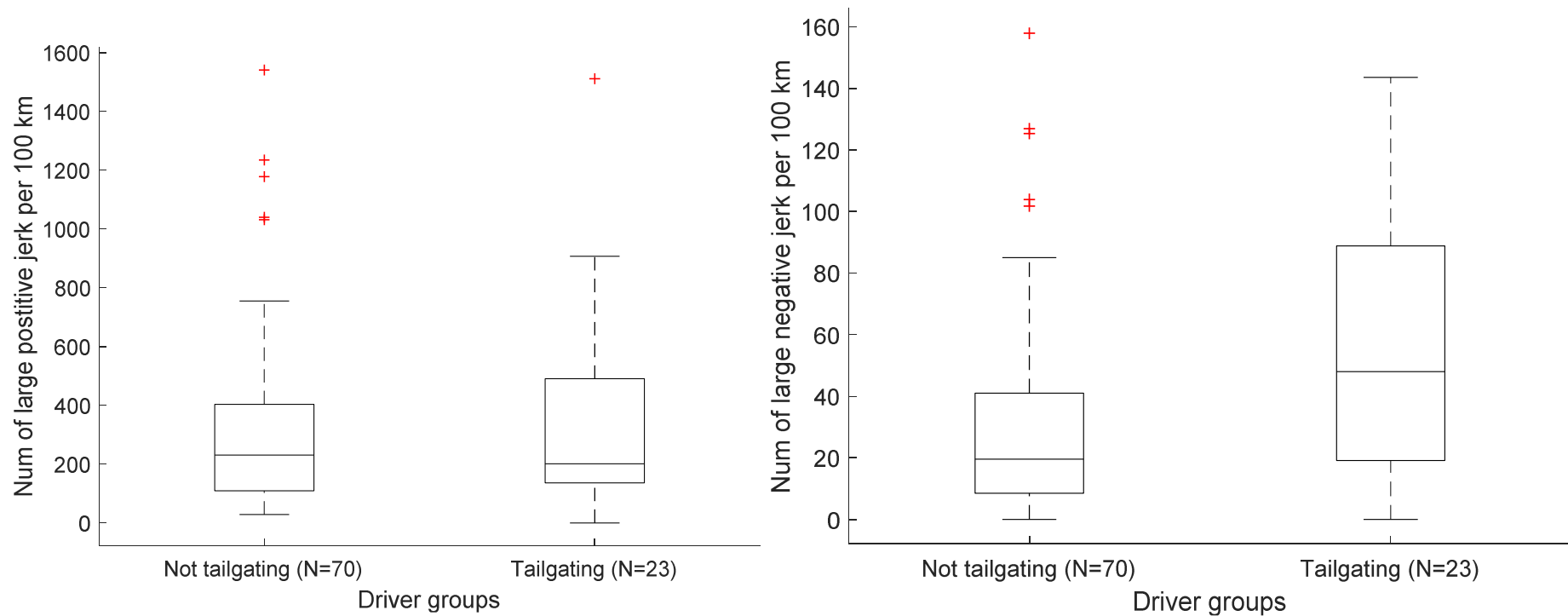
negative jerk
positive jerk

Feng et. al (2017)
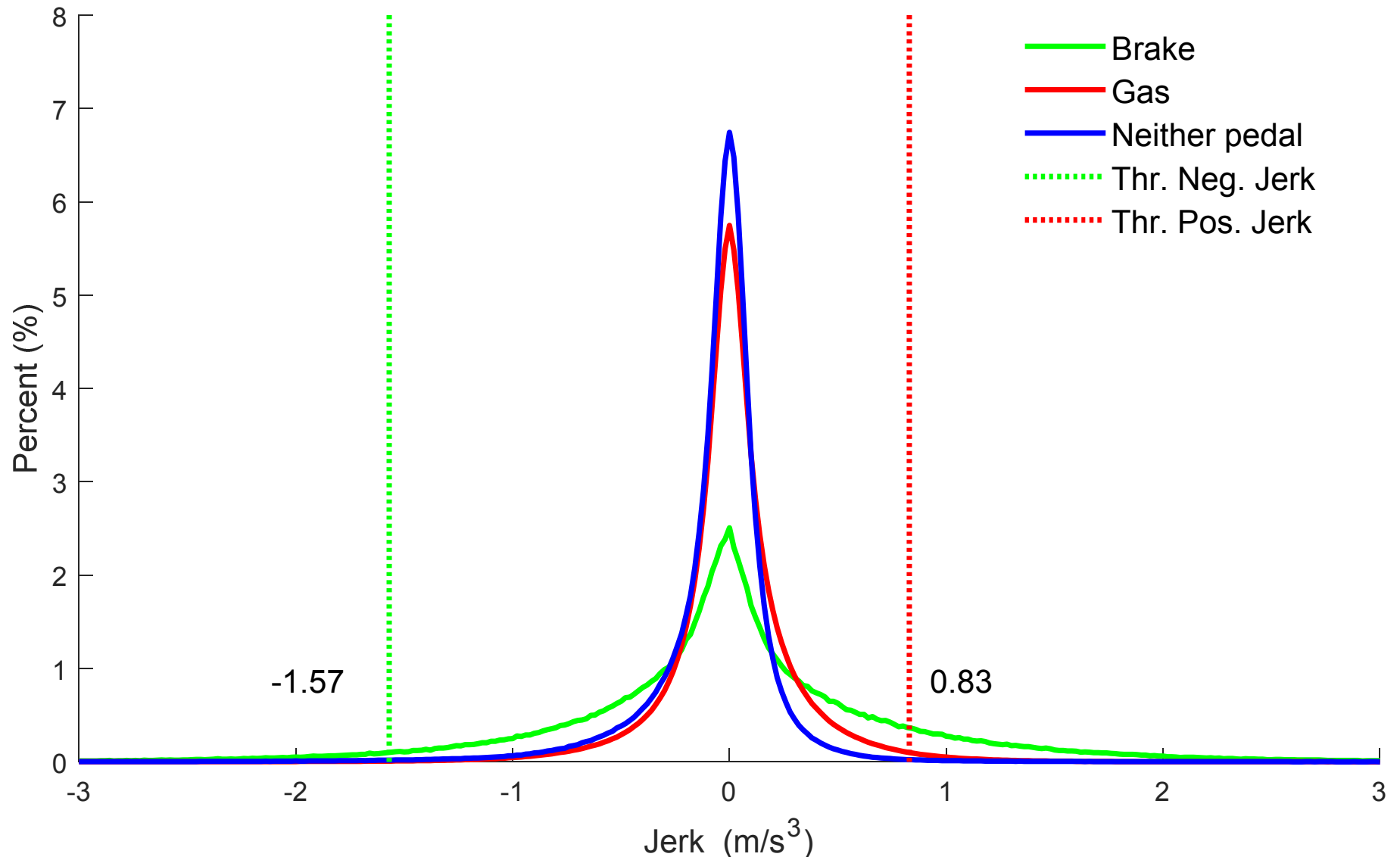
Results

- Total segments of car-following: 126098
- Distance: 72705 km
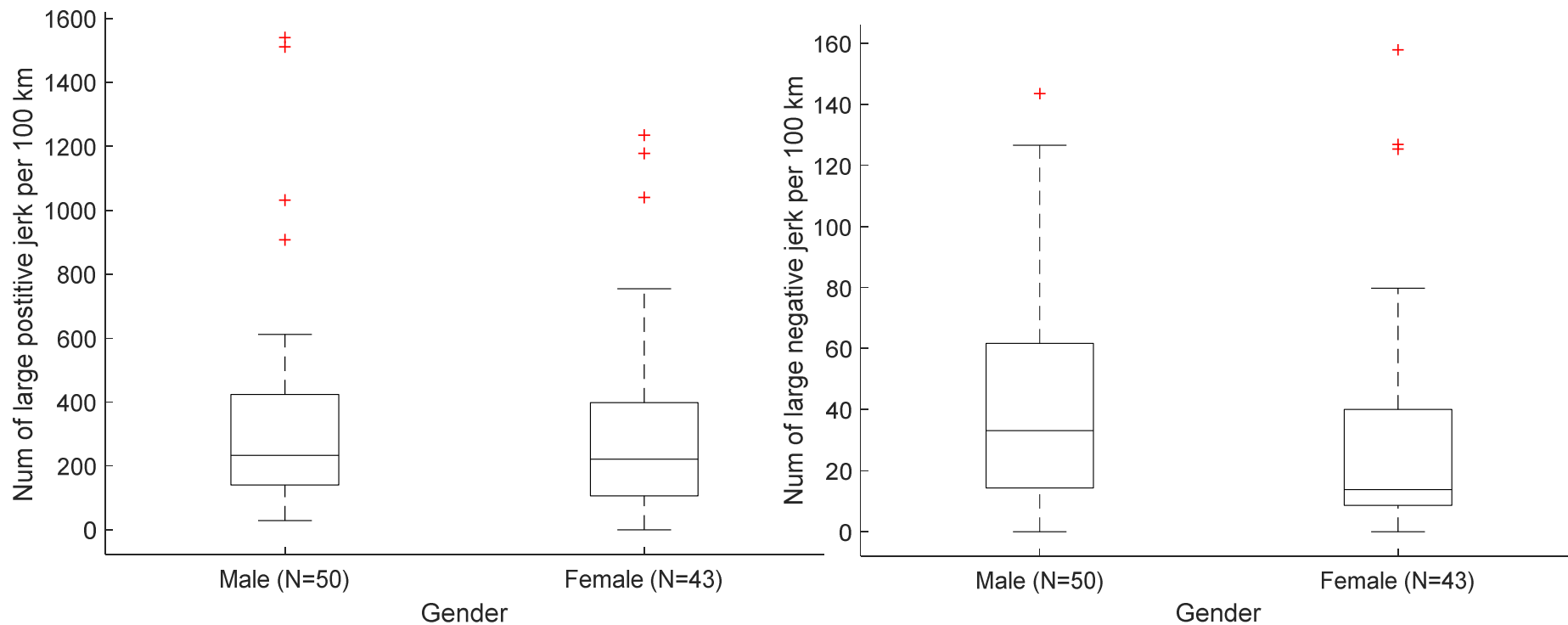- Duration: 758.2 hours
- 93 drivers
  - 50 males and 43 females

Jerk and tailgating

K-W: $\chi^2 (1) = 0.1605$, p = 0.6886 $\chi^2 (1) = 8.3764$, **p = 0.0038**

Jerk and gender

K-W: $\chi^2 (1) = 0.8128$, p = 0.3673 $\qquad$ $\chi^2 (1) = 6.0431$, **p = 0.0139**

Jerk and country

- Positive jerk

  K-W χ^2 (4) = 20 **p = 0.00049**

- Negative jerk

  K-W χ^2 (4) = 19.51 **p = 0.00062**

AISS

- Low AISS group (AISS <= 45)
- High AISS group (AISS > 45)

- Tailgate:
  - Fisher exact **p = 0.0139**
- Positive jerk:
  - K-W: $\chi^2 (1) = 0.2435$, p = 0.6216
- Negative jerk:
  - K-W: $\chi^2 (1) = 1.5286$, p = 0.2163

CHALMERS
UNIVERSITY OF TECHNOLOGY

DBQ

- Low DBQ group (1-3)
- High DBQ group (4-5)

- Tailgate:
  - Fisher exact p = 0.8604
- Positive jerk:
  - K-W: $\chi^2\,(1) = 2.8062$, <u>p = 0.0939</u>
- Negative jerk:
  - K-W: $\chi^2\,(1) = 1.6015$, p = 0.2057

Conclusion

- <u>Aggressive</u> drivers are associated with significantly higher frequency of using large **negative** jerk

- Drivers from different <u>countries</u> have significantly different frequency in using both **positive** and **negative** jerk

- <u>Male</u> drivers have significantly higher frequency of using large **negative** jerk compared to <u>female</u> drivers

- Higher sensation-seeking drivers are more prone to tailgating

Thank you