Association of Expressed Driving Anger with Driving Performance Combining Simulator and Survey Data

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Overview

- **Driving anger** has a serious impact on road safety causing loss of concentration and loss of vehicle control
- The **objective** of the present research is to investigate the effect of anger on driver behaviour and safety focusing on certain characteristics of the driver and driving performance parameters
- Research focused on to what extent driving anger, depending on **certain characteristics of the driver** (e.g. driving experience, age, sex, etc.), contributes to certain driving patterns and the probability of an accident.

Background

Driving anger

- is defined as the aggressive or angry behaviour of a driver
- includes rude gestures, verbal insults and deliberately dangerous or threatening driving
- can lead to quarrels, attacks and conflicts that cause injuries or even fatalities

Driving Anger Expression Inventory

- is a widely used, valid and representative tool for measuring the expression of driving anger

Methodology

Sample

The sample of participants is 125 drivers
- 30 young drivers aged 18-34 years old
- 38 middle aged drivers aged 35-54 years old
- 57 older driver aged 55-80 years old

Driving experiment

Road environment:
- A rural route that is 2,1 km long, single carriageway and the lane width is 3m, with zero gradient and mild horizontal curves

Rural Road 2,1 km
Urban Road 1.7 km
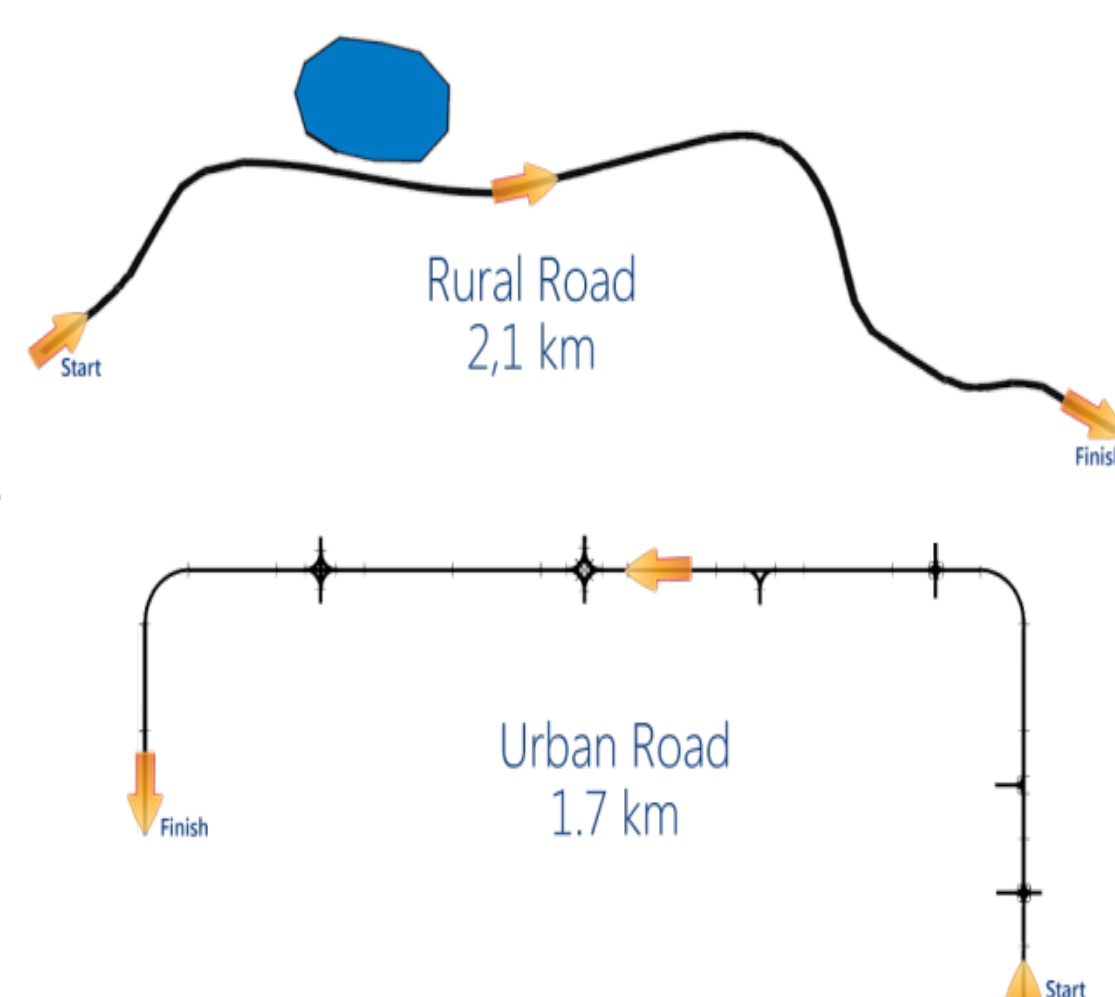
Traffic scenarios:
- Moderate traffic conditions, corresponding to an average traffic volume Q=300 vehicles/hour

Unexpected events
- 2 unexpected incidents occurred at fixed points of the route

Driving behaviour questionnaire
- Driving experience - car use
- Self - assessment of the older driver
- Distraction-related driving habits
- Emotions and behaviour of the driver Anger expression inventory during driving
- History of accidents, near misses, and traffic violations

Factor analysis

- A **factor analysis** was performed in order to reduce the number of independent variables related to anger
- The 4 factors identified as the optimal solution are the following:
  - **external anger**
  - **forgiveness**
  - **internal anger**
  - **noble-mindedness**

	Loadings	Coefficients
Factor 1: External Anger		
I try to cut in front of the other driver	0.753	0.174
I make negative comments about the other driver	0.747	0.138
I glare at the other driver	0.747	0.170
I think things like "Where did you get your license?"	0.734	0.140
I give the other driver the finger	0.676	0.100
I swear at the other driver aloud	0.674	0.128
I shake my head at the other driver	0.663	0.145
I make hostile gestures other than giving the finger	0.639	0.102
Factor 2: Forgiveness		
I pay even closer attention to being a safe driver	0.724	0.197
I think about things that distract me from thinking about the other driver	0.644	0.172
I do things like take deep breaths to calm down	0.638	0.175
I try to think of positive solutions to deal with the situation	0.625	0.161
I turn on the radio or music to calm down	0.584	0.190
I just try to accept that there are bad drivers on the road	0.576	0.149
I decide not to stoop to their level	0.504	0.082
Factor 3: Internal Anger		
I don't accept that there are frustrating situations while driving	0.674	0.223
I break out to others later	0.667	0.245
I drive a little faster than I was	0.643	0.192
I go crazy behind the wheel	0.554	0.191
I break out to fellow passengers	0.534	0.165
Factor 4: Noble-Mindedness		
I don't try to scare the other driver	0.911	0.350
I don't drive right up on the other driver's bumper	0.911	0.350
I tell myself it's not worth getting involved in	0.651	0.202
I decide not to stoop to their level	0.596	0.179

Regression analysis

- The **multiple linear regression** method was chosen for continuous variables
- The method used for the discrete variables was generalized ordinal **logistic regression**

$$Av. Speed = 48.9 + 2 * (Ext. Anger) - 2.1 * (Forgiveness)$$

$$Avg. Time\ Headway = 43.8 - 5.1 * (Ext. Anger) + 6.1 * (Forgiveness)$$

$$P(Speed > Limit) = \frac{1}{1 + e^{1.3 - \{0.5*(Ext.Anger) - 0.94*(Forgiveness)\}}}$$

$$P(Accidents > 0) = \frac{1}{1 + e^{-1.68 - \{-0.84*(Forgiveness)\}}}$$

$$P(Ticket > 0) = \frac{1}{1 + e^{0.59 - \{0.74*(Ext.Anger) - 0.49*(Noble-Mindedness)\}}}$$

Conclusions

- Driving anger is a **multidimensional phenomenon** which means that no single driving performance measure/experimental methodology can capture all effects of anger
- The influence of driving anger on the **average speed**, the probability of violating the **speed limit** and the number of road **traffic violations** were confirmed
- The association of anger with **driver characteristics** (age and gender) was quantified
- Examination of drivers' reactions the moment they appear to be in anger are essential for a deeper understanding of the **mechanism** of anger in driving
- Investigation of **intervention strategies** to eliminate the adverse effects of anger while driving