# Scope

➢ **Interaction** of driving behavior's elements with each other

➢ Definition of the overall **traffic behavior** of the driver

➢ Identification of those characteristics that contribute to a more **risky driving** behavior compared to those of more cautious drivers

**Correlation of driver's characteristics and road safety performance**
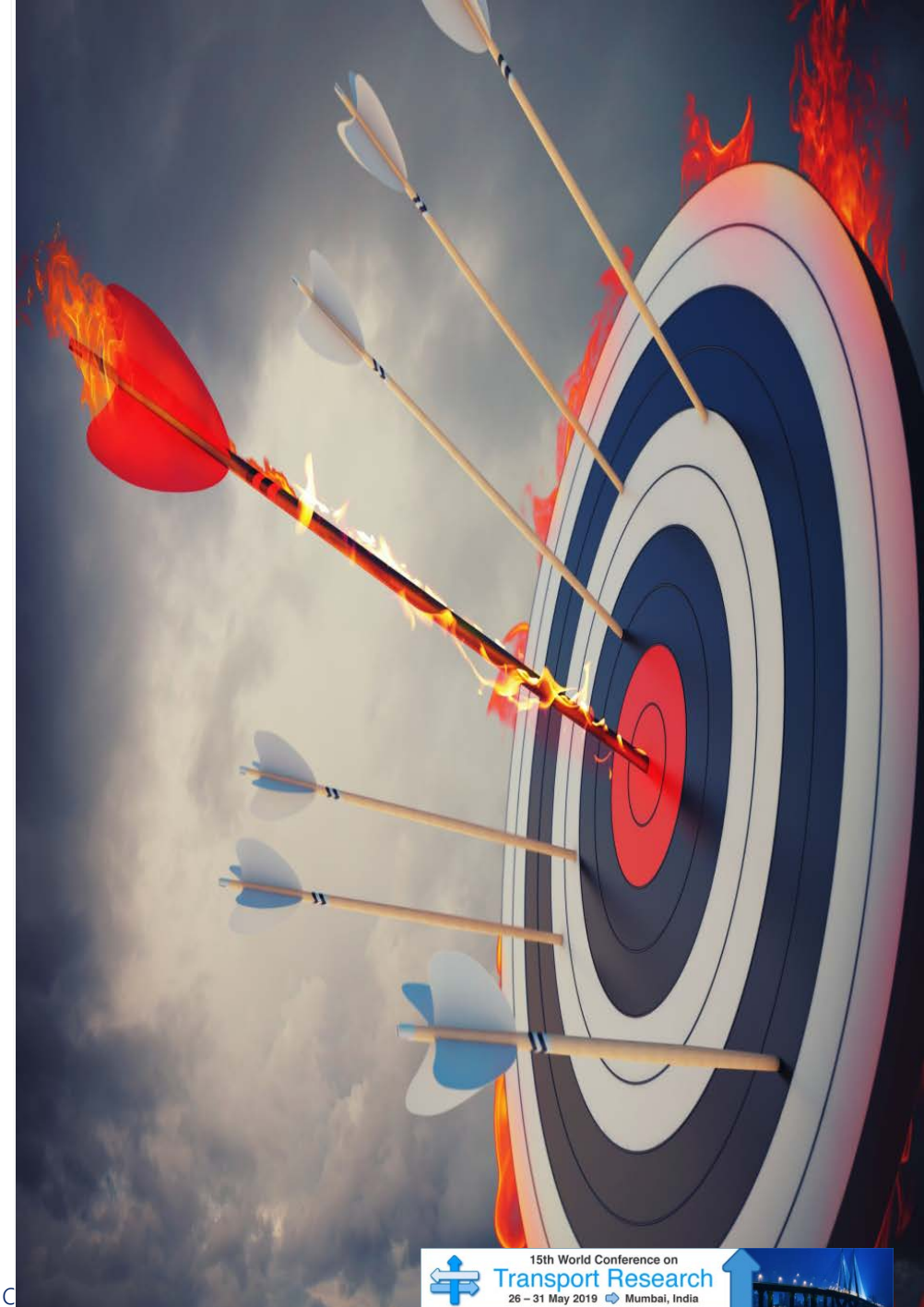
# Background (1/2)

➢**Road accidents factors**
  - ➢ Vehicle
  - ➢ Road environment
  - ➢ Human factor

➢**Driving behaviour characteristics**
  - ➢ Speeding
  - ➢ Harsh braking/ acceleration/ cornering
  - ➢ Understanding, perception and quality of traffic participation
  - ➢ Seatbelt use
  - ➢ Mobile phone use

# Background (2/2)

Literature Review findings:

➢ Development of a driver's risk indicator with aim to assess the effects of driver's characteristics on road safety.

➢ Use of factor analysis, to minimize the dimensionality of a dataset and identify the critical factors that describe adequately driving behavior.

➢ Use of cluster analysis, to classify drivers as "less risky" and "risky" or "efficient" and "inefficient" drivers.

➢ Drivers' self-assessment in conjunction with feedback for their actual driving behavior may reduce their driving risk.

# Methodology

Statistical analysis of the selected data in two steps:

➢ **Factor analysis to reduce the dimensionality of the dataset and identify the main factors**
  ➢ Significant number of variables
  ➢ Correlation between the variables
  ➢ Collation of variables into factors
  ➢ Interpretation of the factors

➢ **Multiple linear regression model**
  ➢ Continuous (dependent) variable Y
  ➢ Explanatory (independent) variables X
  ➢ No correlation among the independent variables

$$Y_i = \beta_0 + \beta_1 * X_{1\iota} + \beta_2 * X_{2\iota} + \beta_3 * X_{3\iota} + \cdots + \beta_k * X_{k\iota} + \varepsilon_\iota$$
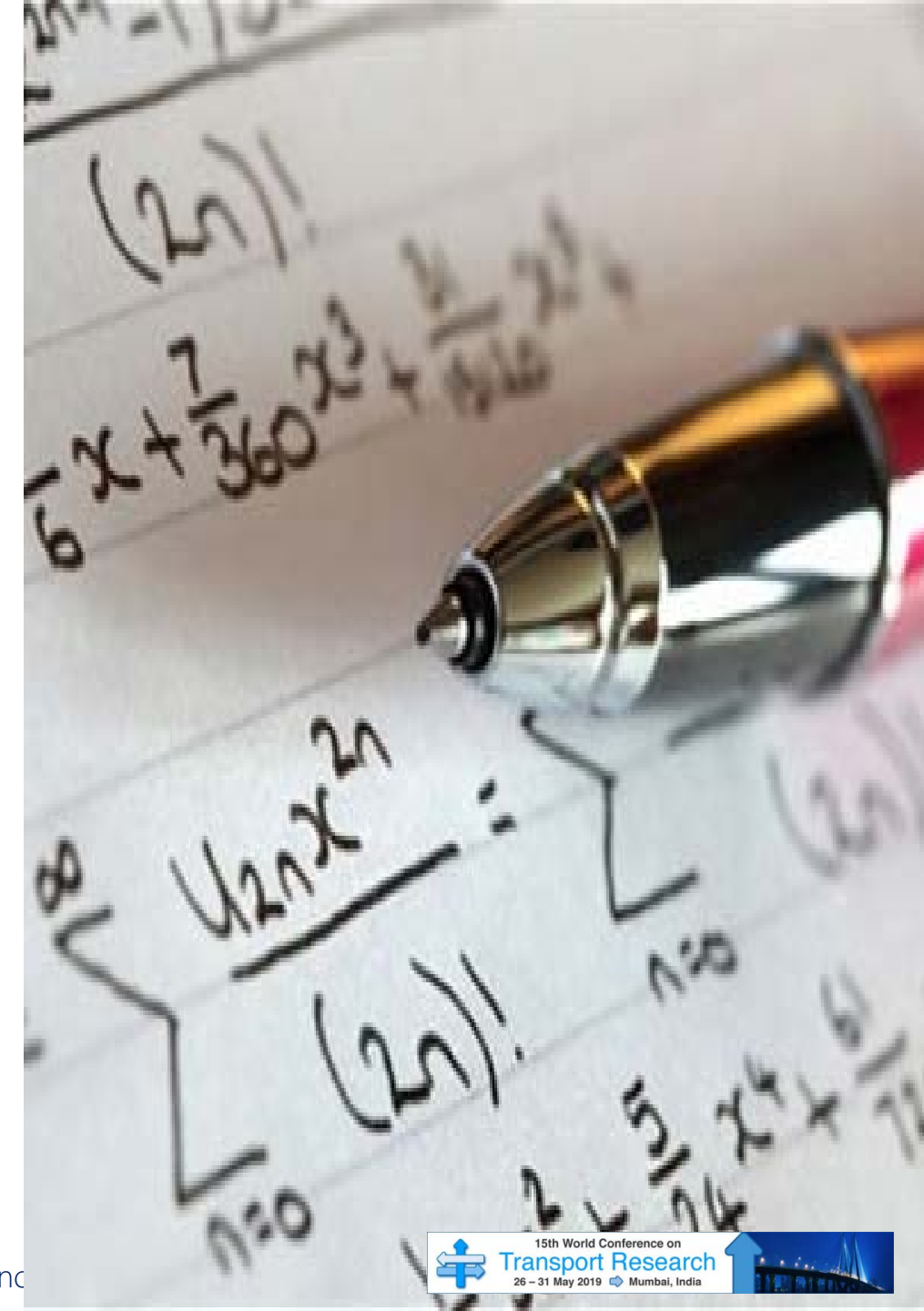
# Data collection (1/2)

- On-road driving experiment
  - Assessment of **12 participants** on 16 driving characteristics
  - **8.8 kilometers** of urban and interurban road network
  - **21 minutes** total travel time
  - **Interurban** section was selected in the analysis
  - **In-car** safety behavior **expert**
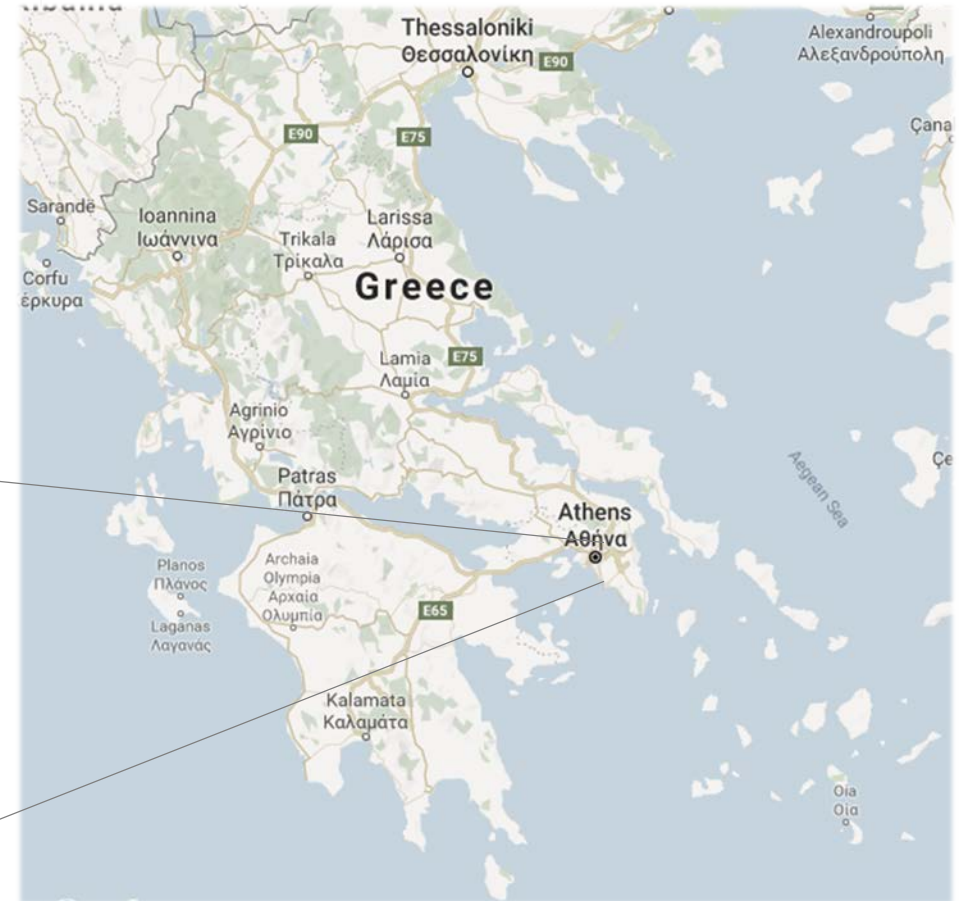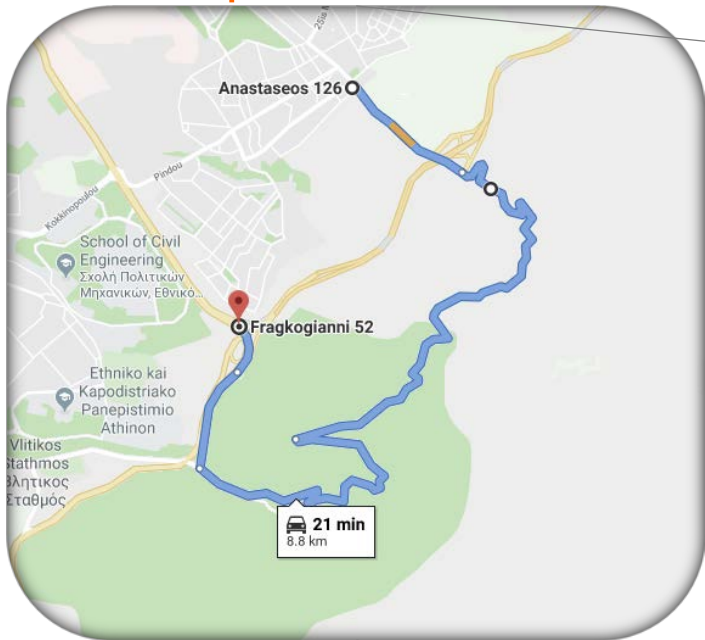
# Data collection (2/2)

➢ Survey
   ➢ Questionnaire of 78 questions
   ➢ Basic demographics (age, gender, education, etc.)
   ➢ Driving experience (kilometers travelled inside and outside urban areas, etc.)
   ➢ Potential offending behavior (number of accidents, traffic infringements, etc.)
   ➢ Self-evaluation questions about driving behavior (risky driving, steep acceleration, how cautious is as a driver, etc.)

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# Driving Assessment

Table 1: List of driving indicators used for the assessment of driver's performance

| a/a | Indicator | a/a | Indicator |
|---|---|---|---|
| 1 | Speed adaptation | 9 | **Understanding, perception and quality of traffic participation** |
| 2 | Braking | 10 | **Crossing or junction** |
| 3 | Accelerating | 11 | **Anticipation and perception of road signs and traffic signals** |
| 4 | Turning | 12 | **Joining the traffic stream** |
| 5 | Headways | 13 | **Visual behavior and communication** |
| 6 | Lateral Position | 14 | **Mirror use** |
| 7 | Ability to choose the correct lane | 15 | **Use of direction indicator** |
| 8 | **Lane change** | 16 | **Steering firmness** |

# Main factors (1/2)

➢ **4 factors** are extracted, from which only the three first variables are analyzed, since the last one cannot be adequately interpreted.

➢ All 3 factors explain the **68,54% of the total variance**.

➢ These factors describe drivers' **characteristics** and their **perceptions** on their behavior

Cautious Driving **15,15%** — 3

Aggressive Driving **16,68%** — 2

Careless Driving **36,71%** — 1
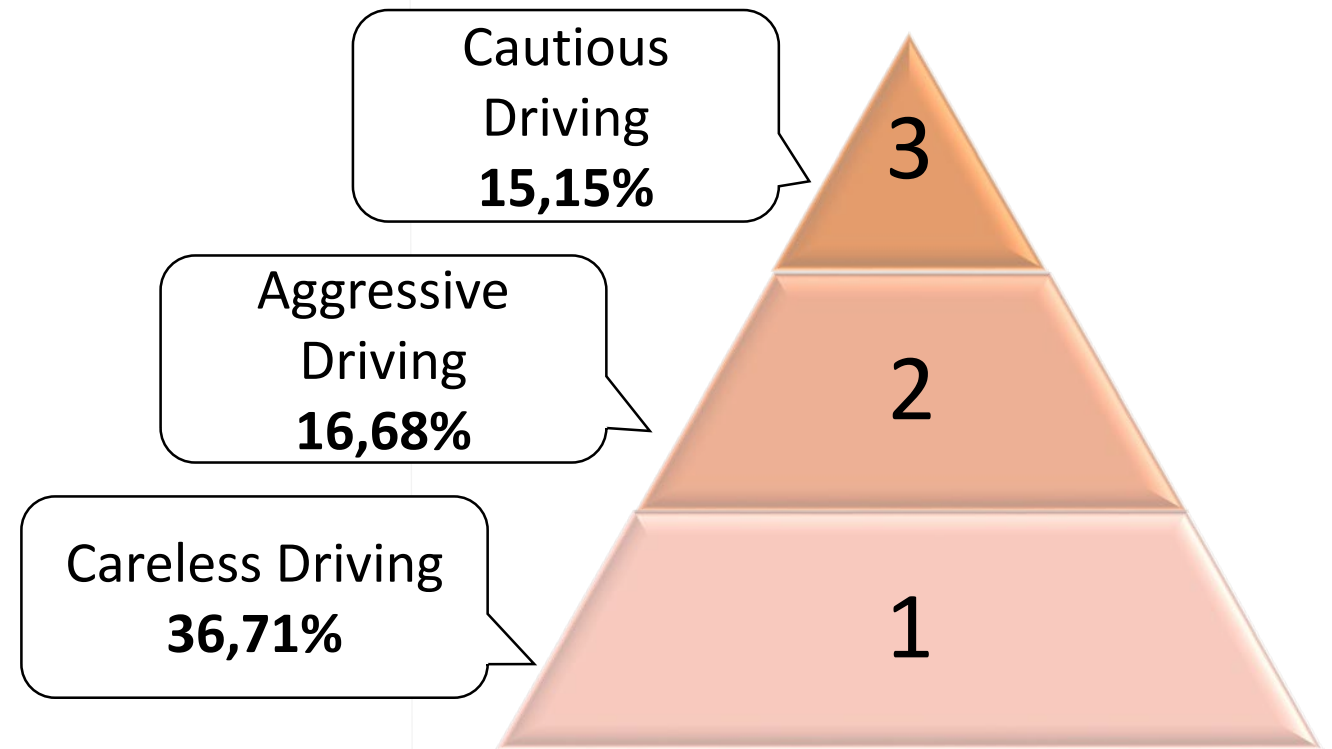
# Main factors (2/2)

Table 2: Variable loadings on the estimated factors

| Variables | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|---|---|---|---|---|
| In how many accidents were you involved as a driver? | .740 | | | |
| During the last two years, how many times did you offend the Traffic Law while driving? | | .714 | -.541 | |
| At what extent do you keep the speed limits while driving on motorways? | -.926 | | | |
| How aggressive would you assess yourself as a driver? | | -.667 | | |
| How often do you consider your braking to be harsh? | .860 | | | |
| How often do you consider your acceleration to be harsh? | .680 | | .660 | |
| How often do you consider your turning to be harsh? | .898 | | | |
| Braking | | -.523 | | |
| Accelerating | | .589 | | .625 |
| Headways | | | -.550 | .653 |

# Linear regression model (1/2)

## Dependent variable:

➢ Overall on-road driving performance score (Indicator of driver's overall performance under normal driving conditions, as assessed by an expert, at a scale from 0% to 100%)

## Independent variables:

➢ Years of driving
➢ Headways (participant's distance from the vehicle in front)
➢ Self-Efficiency (participant's self-assessment on driving efficiency)
➢ Defensive driving (participant's ability to forecast, identify and take all necessary actions to safely avoid potential accident risks)
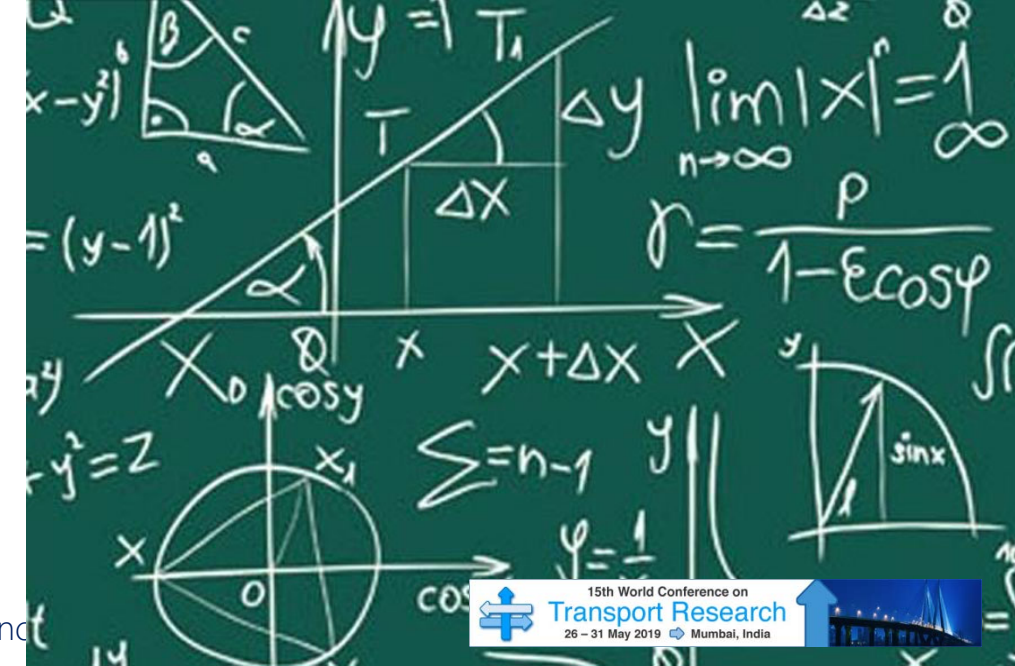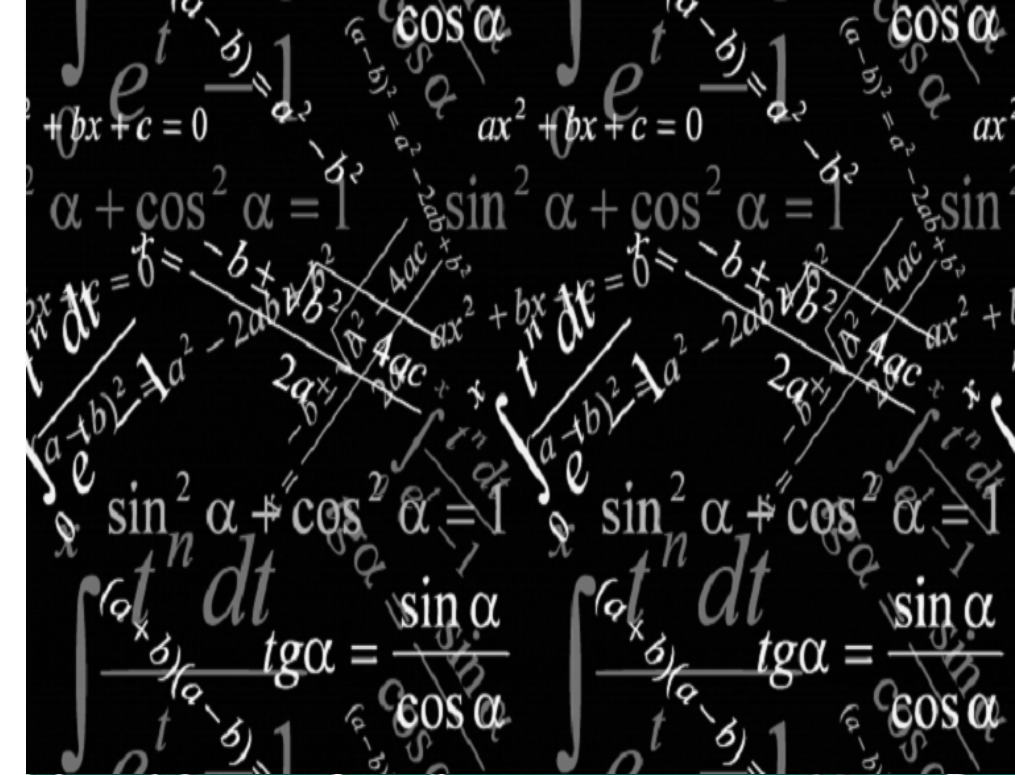
# Linear regression model (2/2)

Table 3: Parameter estimates and fit of the linear regression model

| | Unstandardized Coefficients | | Standardized Coefficients | t | p-value |
|---|---|---|---|---|---|
| | B | Std. error | Beta | | |
| (Constant) | .449 | .056 | | 8.067 | .000 |
| Years of driving | .010 | .003 | .569 | 3.250 | .014 |
| Headways 4 | .142 | .044 | .555 | 3.198 | .015 |
| Efficient driver 3 | .141 | .049 | .554 | 2.857 | .024 |
| Defensive driving 3 | .108 | .044 | .424 | 2.444 | .045 |
| Adjusted $R^2$ | 0.721 | | | | |
| F statistic | 8.155 | | | | |
| df | 11 | | | | |

# Conclusions (1/2)

➤ **Driving experience** is the most important factor in predicting driving safety behavior and efficiency as expressed in the total driving assessment

➤ Overall, the total set of actions/ behavior that allows the driver to predict identify and take appropriate action to avoid potential risk composes the factor of **defensive driving** and significantly affects total driving safety behavior

➤ Keeping the appropriate **headways** from the vehicle ahead and self-reported dexterity have a positive impact on the overall performance indicator

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# Conclusions (2/2)

The factors describing the correlation between driver safety features and performance can be grouped into **three groups** each of which includes:

- ➤ Drivers' perception of **superficial driving**, including features related to dangerous road behaviors.

- ➤ The perception of **aggressive behavior**, through questions related to the reported number of violations and errors as assessed in the experimental process.

- ➤ Drivers' perception of **cautious driving**, including the self-reported frequency with which the driver abruptly brakes, but also how well he keeps distances from the vehicle ahead.

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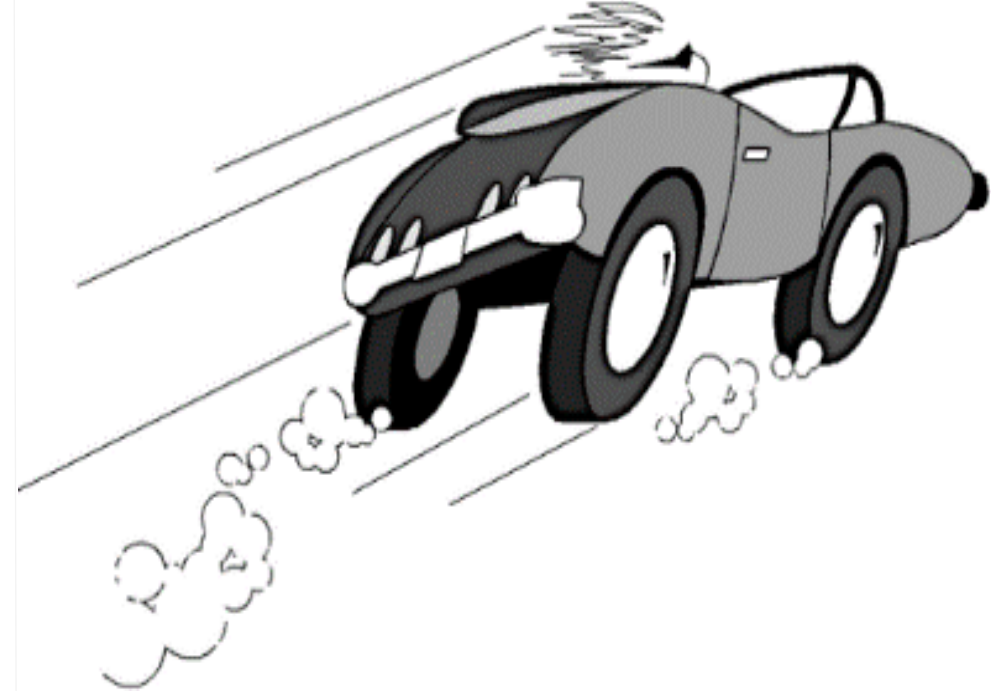
# Future research

➢ Implementation of the experiment with a larger number of participants, in different traffic conditions and other road environments (urban, motorway, high / low traffic, day / night etc.).

➢ Comparison between the findings of this research and the driving characteristics of a driver in a driving simulator.

➢ Use state-of-the-art technology for driver's behavior monitoring together with driving assessment by an expert.

➢ Further statistical analysis by applying other methods of a different family than the one selected.

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# Investigating the Correlation between Driver's Characteristics and Safety Performance

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