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HIT- HELLENIC INSTITUTE OF TRANSPORT

HELLENIC INSTITUTE OF TRANSPORTATION ENGINEERS

11th INTERNATIONAL CONGRESS on TRANSPORTATION RESEARCH

Clean and Accessible to All Multimodal Transport

Heraklion, Crete, September 20th - 22nd 2023

How do task complexity and coping capacity influence risk?

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The i-DREAMS project

- 13 Project partners:
  - National Technical University of Athens

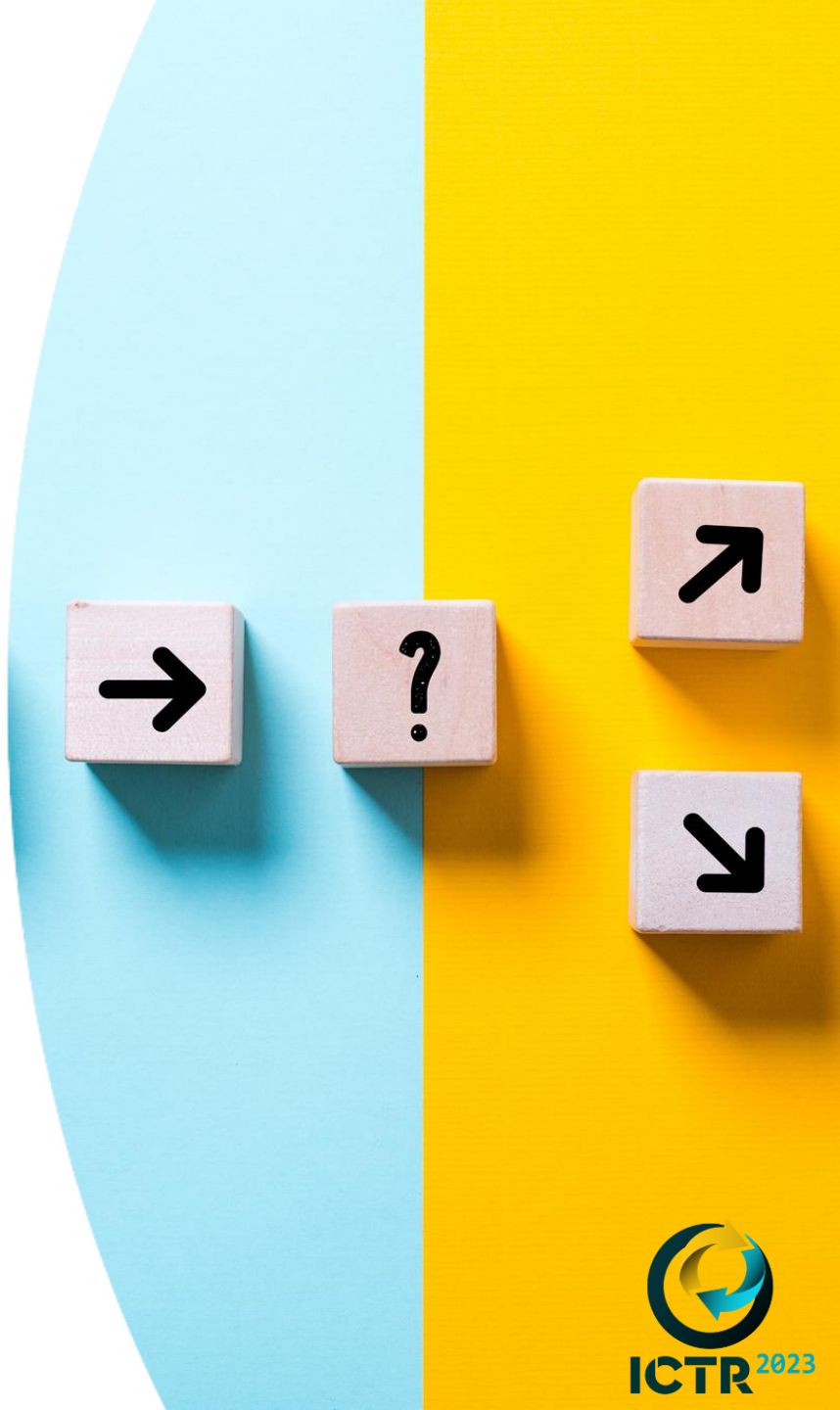
    Universiteit Hasselt, Loughborough University, Technische Universität München, Kuratorium für Verkehrssicherheit, Delft University of Technology, University of Maribor, OSeven Telematics, DriveSimSolutions, CardioID Technologies, European Transport Safety Council, POLIS Network, Barraqueiro Transportes S.A.
- Duration of the project:
  - 48 months (May 2019 – April 2023)
- Framework Program:
  - Horizon 2020 - The EU Union Framework Programme for Research and Innovation - Mobility for Growth

Introduction

- Road crashes claim the lives of 1.3 million people every year
- Driver behavior is a key factor in over 90% of these crashes
- Identifying drivers who engage in unsafe practices is important, as they pose a greater risk to themselves and other road users
- Personality and risk perception assessments also aid in identifying high-risk behaviors

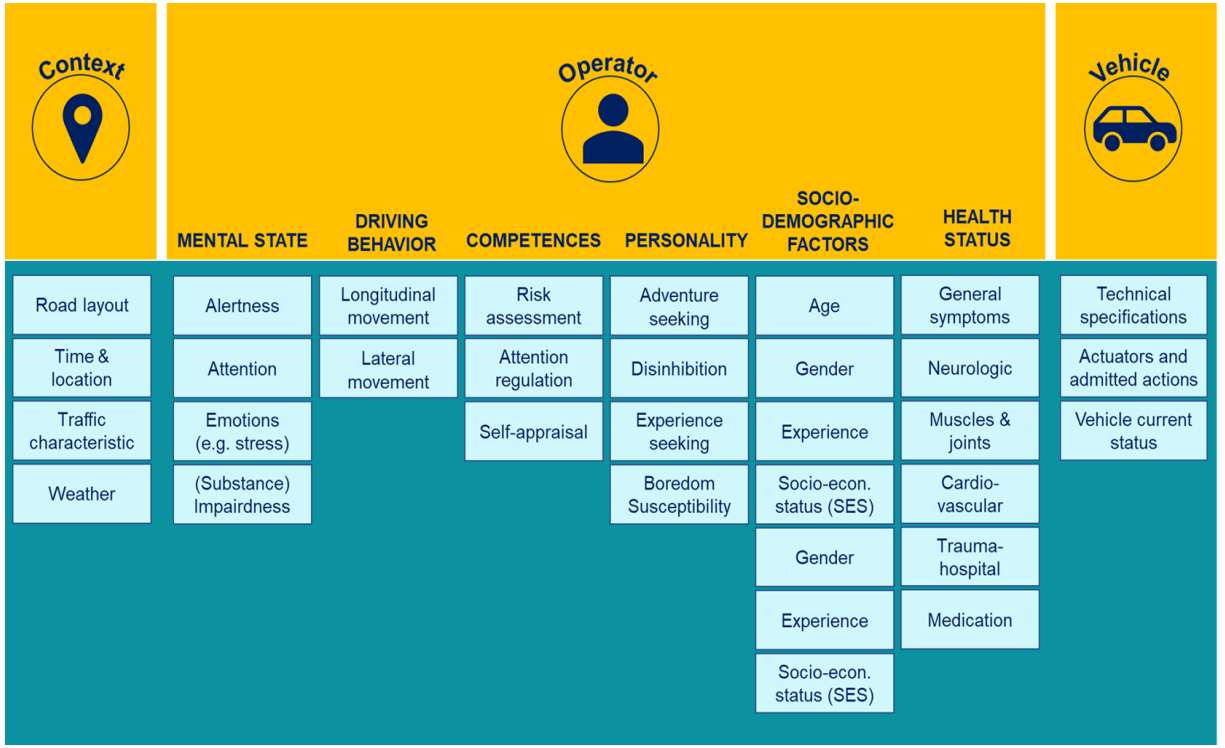
Objectives

- Examination of the interrelationship between the risk indicators (i.e., task complexity and coping capacity)
- Analysis of the impact of task complexity and coping capacity on risk
- An integrated model is applied in order to gain an in-depth understanding of inter-relationship of vehicle, operator, and context characteristics with risk



Definitions

- **Task complexity** relates to the current status of the real-world context in which a vehicle is being operated:
  - road layout (i.e. highway, rural, urban)
  - time and location
  - traffic volumes (i.e. high, medium, low)
  - weather conditions
- **Coping capacity** is dependent upon two underlying factors, and it consists of several aspects:
  - vehicle state (e.g. technical specifications, actuators & admitted actions, current status)
  - operator state (e.g. mental state, behaviour, competencies, personality, sociodemographic profile)

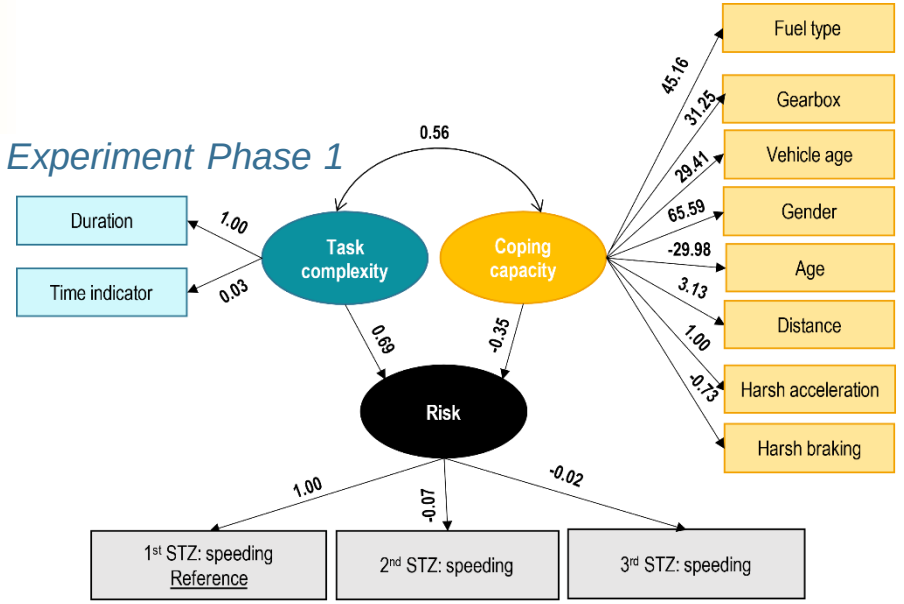


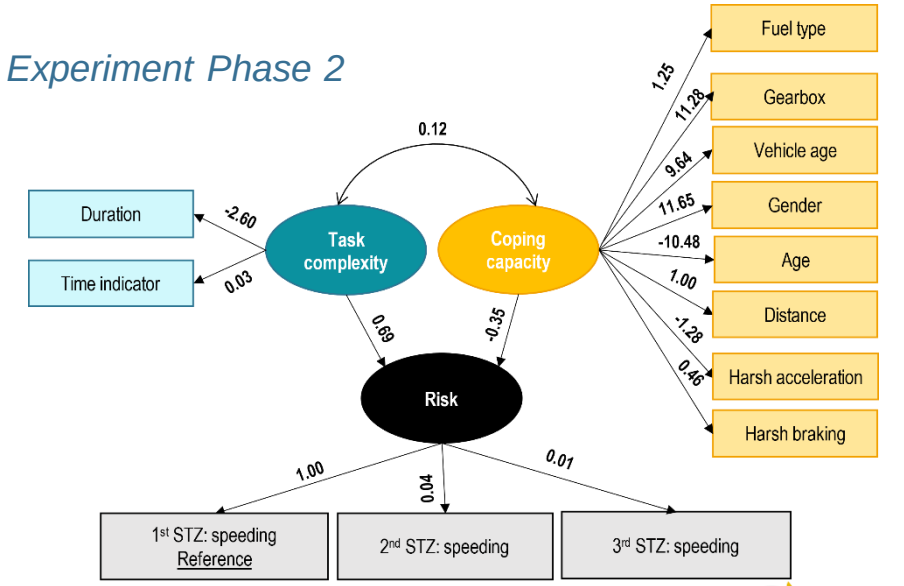
Methodology

- As part of the i-DREAMS project a naturalistic driving experiment was conducted into three phases involving 65 car drivers from Greece and a large database consisting 9,066 trips was collected and analyzed
- Questionnaire data were also collected both pre-trial (i.e. driver and vehicle details, opinions on ADAS, driving behavior, safety etc.) and post-trial (i.e. user feedback etc.)
- Structural Equation Models (SEMs) were developed to model complex and multi-layered relationships between observed (i.e. task complexity and coping capacity) and unobserved variables (i.e. crash risk)

SEM Results (1/2)

- The latent variable risk was measured by means of the STZ levels for speeding
- For phase 1 and 2, task complexity and coping capacity were inter-related with a positive correlation, which implies that driver's coping capacity increases as the complexity of driving task increases
- In phase 3, task complexity and coping capacity were negatively correlated





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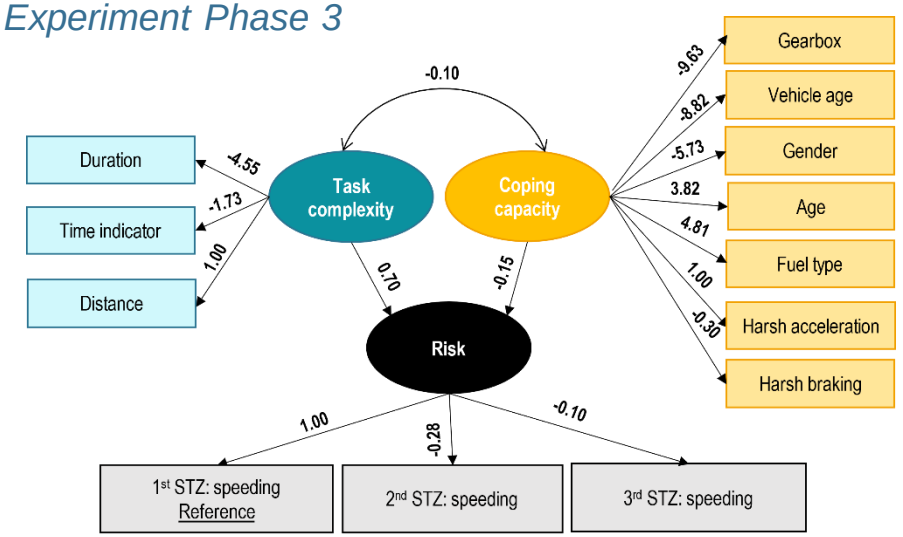
SEM Results (2/2)

- Overall task complexity and inverse risk (normal driving) are positively correlated among the three phases, which indicates that increased task complexity relates to increased risk
- On the other hand, coping capacity and risk found to have a negative relationship in all phases of the experiment, which means that increased coping capacity relates to decreased risk

Experiment Phase 3



Discussion

- Higher task complexity may overwhelm drivers and lead them to pay less attention to the road and to other road users, and thus increase the risk of a crash

- On the other hand, lower coping capacity is associated with an increased risk. Limited capacity (e.g. slower reaction times, impaired judgment, and difficulties in prioritizing information) can make it difficult for the driver to manage complex tasks effectively, leading to a higher risk of crash

- Higher task complexity levels lead to higher coping capacity by the vehicle operators. This means that drivers when faced with difficult conditions tend to regulate well their capacity to react to potential difficulties, while driving

Conclusions

- The analysis of the inter-relationship between driving task complexity, coping capacity, and crash risk is a multifaceted and crucial area of study in order to develop targeted interventions
- Incorporating information on factors like road configuration, traffic density, and other relevant metrics would be very useful in order to establish the complexity of the driving task and its association with risk
- The advancement of emerging technologies in the field of road safety can mitigate crash risk and support drivers in operating within safe boundaries by reducing the cognitive overload associated with the complexity of task and the coping capacity

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