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An integrated model of driver-vehicle-environment interaction and risk

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Introduction

The **fundamental challenge** within the i-DREAMS project is how explanatory variables of task complexity (e.g. road layout, time and location, traffic volumes, weather) and coping capacity (e.g. vehicle and operator state) are correlated with risk in order to predict Safety Tolerance Zone (STZ).

Objectives

The purpose of this study is to identify the most critical precursors of risk from task complexity and coping capacity side and **implement an integrated model** for understanding the effect of vehicle, operator and context characteristics with risk under different conditions.

Methodology

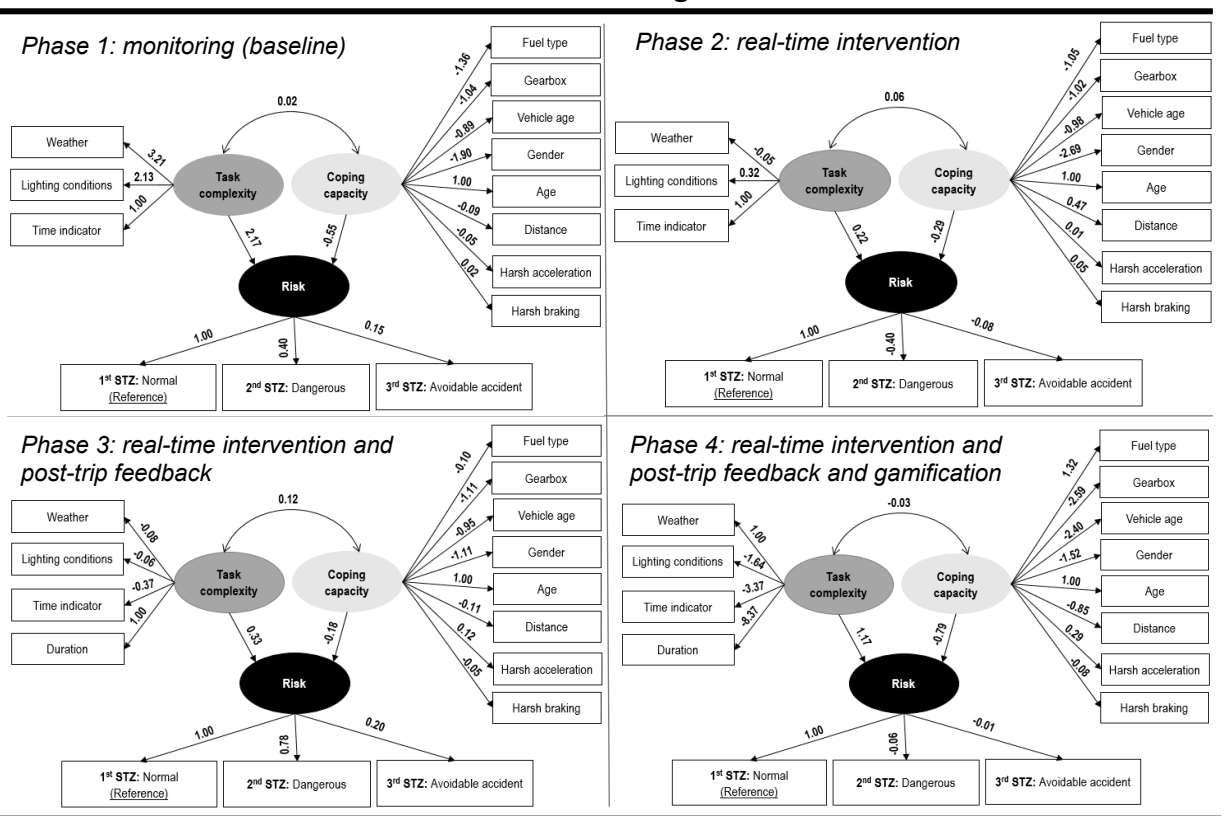
In order to fulfill the aim of this research, a naturalistic driving experiment was carried out, involving 130 car drivers from Belgium, Germany and UK and a large database of 26,908 trips was analyzed. **Structural Equation Models (SEMs)** were applied for modeling the complex and multi-layered relationship between observed (e.g. number of speeding events) and unobserved variables (e.g. crash risk).

Results

The **latent variable risk** was measured by means of the STZ levels for speeding, headway, overtaking and fatigue (level 1 'normal driving' used as the reference case). Results showed that higher task complexity levels lead to higher coping capacity. This means that drivers, when faced with difficult conditions, tend to regulate well their capacity to apprehend potential difficulties, while driving.

SEM Analysis

It was revealed that the SEM applied between task complexity and inverse risk were positively correlated in all phases of the experiment, which means that increased task complexity relates to increased risk. On the other hand, coping capacity and inverse risk found to have a negative relationship in all phases, which means that increased coping capacity relates to decreased risk. Overall, **the interventions had a positive influence on risk**, increasing the coping capacity of the operators and reducing the risk of dangerous driving behavior.



Conclusions

The integrated model of driver-vehicle-environment interaction and risk can improve safety of all travelers, through the unobtrusive monitoring of driving behavior. This treatment of task complexity, coping capacity and risk could be a **solid base for the road transport safety planning and governance** or the use of friendly techniques, such as gamification tools, can be promoted for better travelers' connectivity and interaction with the devices. Authorities may use data systems at population level to plan mobility and safety interventions, set up road user incentives, optimize enforcement and enhance community building on safe traveling.

Safety tolerance zone calculation and interventions for driver-vehicle-environment interactions under challenging conditions

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