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iDREAMS

Risk Factors, Monitoring Techniques, and Intervention Strategies: Experiences and Lessons from Different Transport Sectors

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Background

- Operator behaviour accounts for the majority of accidents in various transport sectors

  Examples: mental state (fatigue, sleepiness, stress, emotions, illness, distraction), speeding, tailgating and illegal maneuvering

- **On roads:** human factors contribute to about 95% of roadway accidents

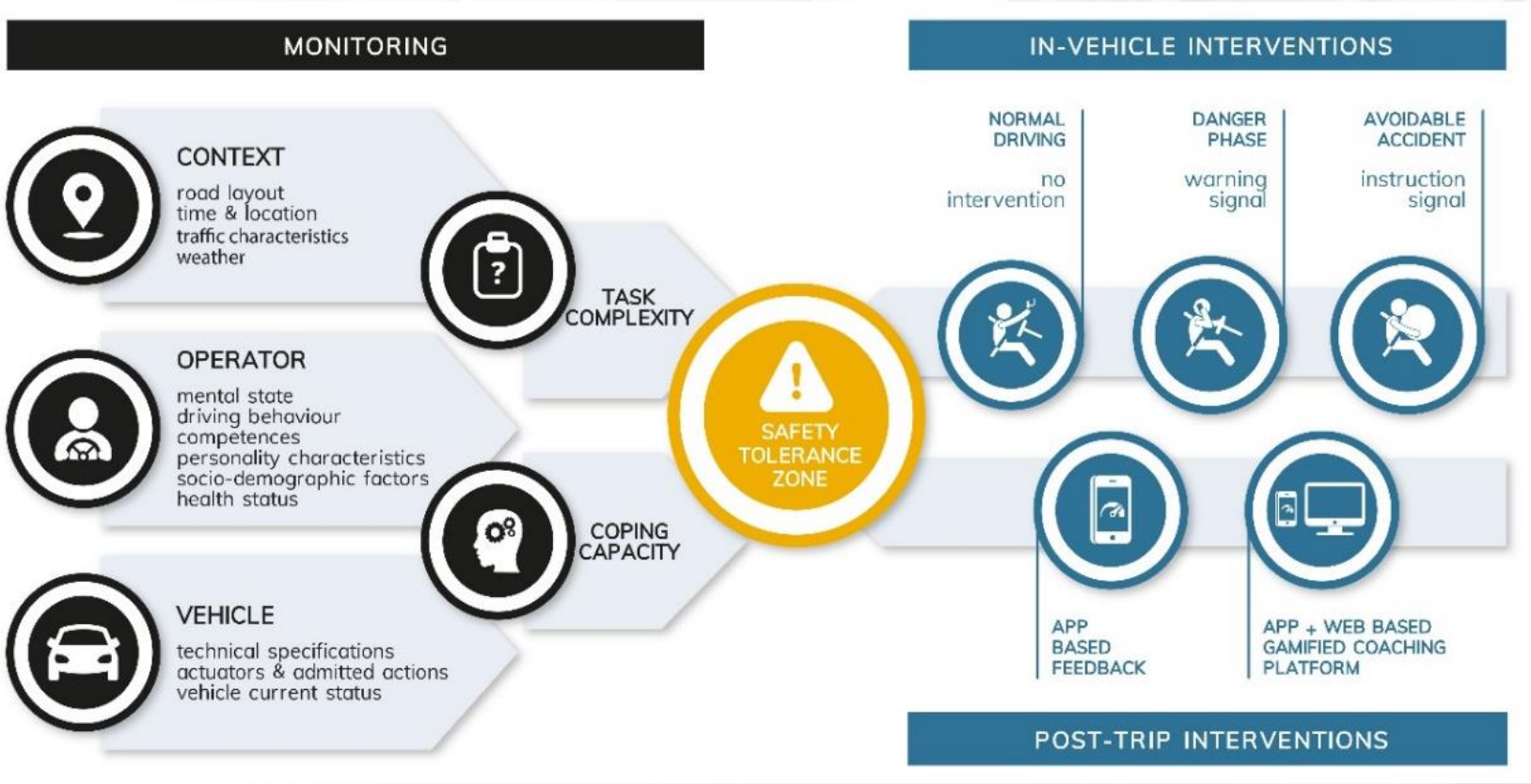
- **On air:** about 75% of aircraft accidents have some human cause

- **In sea:** about 60% of shipping accidents being due to human error

- **Monitoring** techniques and Advanced operator **assistance** systems

Overview of iDREAMS

It aims to set up a platform to develop, test and validate a ‘Safety Tolerance Zone’ (**STZ**), to prevent drivers from getting too close to boundaries of unsafe operation.



Overview of iDREAMS

- **Risk Factors**: tailgating (headway), illegal overtaking, speed, fatigue and drowsiness, presence of pedestrians, distraction, stress, emotions, illness

- **Technologies**: accelerometer (Mobileye), GPS, in-vehicle camera, heart rate wearable devices, heart rate sensors on the steering wheel, smartphone apps

- **Real-time interventions**: speeding warning, fatigue warning, forward collision warning, lane departure warning, pedestrian warning

- **Post-trip interventions**: driver scoring and gamification via smartphone app to achieve sustainable behaviour over time

Overview of iDREAMS technologies

Transfer of knowledge with other modes

- iDREAMS is road-focused, with its technologies tailored for vehicles.
- The STZ concept itself may be relevant and useful for other modes.
- Monitoring systems and interventions exist in other modes, so we can learn from one another.

Our objective: to identify topics and opportunities for transfer of knowledge between i-DREAMS and other transport modes: **aviation, maritime and rail**

Our methods: Identifying common risk factors between sectors, and reviewing the state-of-the-practice in the literature

Areas for transfer of knowledge

Common risk factors

- Fatigue & drowsiness
- Distraction
- Stress, emotions, illness
- Speeding
- Situational awareness
- Tailgating

Relevant technologies

- In-cab sensors
- Wearables
- Smartphones
- Eye-tracking

Interventions

- Monitoring risk
- In-cab warnings / real-time
- Post trip feedback

Example questions:

- What are the main on-board safety systems in maritime / aviation?
- What type of warnings are triggered?
- How is technology used to monitor / support the operator?
- Which iDREAMS aspects could be transferable to other modes?
- Is post-trip feedback useful in maritime / aviation?

Methodology

- **Search strategy (**Google scholar and Scopus**):**

  <operator> OR <transport mode> AND <risk factor>

  Example: <pilot> OR <aviation> AND <fatigue>

- **Number of articles and reports** after filtering and backward snowballing:

  Rail: 6, maritime:12 , aviation: 21

Findings

Aviation

- **Key risk indicator:** control errors and/or loss of control
- **Key risk factors:** fatigue, sleepiness, workload, spatial disorientation, hypoxia, sleep deprivation, stress, and situational awareness
- **Monitoring techniques:** heart-rate measurements, eye tracking techniques, and speech recognition
- **Gaps:** unobtrusive sensors missing, post trip interventions missing, automation/intervention exists, but not explicitly aimed at the operator

Findings

Maritime

- **Key risk indicator:** CPA (closest point of approach
- **Key risk factors:** Fatigue, sleepiness, workload, spatial disorientation, hypoxia, sleep deprivation, stress, and situational awareness
- **Monitoring techniques:** proactive treatments (taking a nap, caffeine intake, proper sleep environment, sufficient hours of uninterrupted sleep) + in-cabin collision alert systems and blue light exposure
- **Gaps:** interventions discrete and not standardized, post trip interventions missing

Findings

Rail

- **Key risk indicator:** SPAD (signal passed at danger)
- **Key risk factors:** Fatigue, sleepiness, workload, stress, illness, and situational awareness
- **Monitoring techniques:** wireless wearables, heart rate and Galvanic skin response for monitoring + in-cab Driver Advisory Systems (DAS)
- **Gaps:** interventions discrete and not standardized, post trip interventions missing

Conclusions

- Many risk factors are common between modes, but there is no systematic way of dealing with them.
- Systematic monitoring techniques and unobtrusive technologies may be established to unite discrete practices in all modes.
- Post-trip feedback to operators can be transferred to other modes.
- Lessons learned from iDREAMS about monitoring the operators and post-trip interventions can be transferred to other modes

Next steps

- In-depth interviews with regulators, network / terminal / fleet safety managers, operator trainers, academic experts
- Qualitative thematic analysis of interviews
- Combining insights from literature review with insights from interviews

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Thank you very much for listening!