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Towards behavioral models for autonomous driving acceptance

Paper ID# 718 Foteini Orfanou[a], Truls Vaa[b], Eleni I. Vlahogianni[a], George Yannis[a]
[a]National Technical University of Athens, 5, Iroon Polytechniou, Athens GR-15773 Athens Greece
[b]Transportokonomisk Institutt, Gaustadalleen 21, Oslo 0349, Norway

Introduction

- Acceptance of users relies on the understanding and trust automation.
- Development of AVs successfully handling the risks of traffic as an "average driver" is necessary.
- Modelling behaviour of an AV is vital for safe vehicles of high driving performance.
- Integration of existing models to autonomous vehicles requires modelling the behaviour of the AV "driver"/operator.

Scope of this work

- Analysing the aspects of AV "driver"/operator behaviour.
- Conceptualizing the changes that should be introduced to existing behavioural models.
- Addressing the requirements of AV traffic and road safety and increase the acceptance.
- Three popular modelling alternatives:
  - Summala's Multiple Comfort Zone
  - Fuller's Risk Allostasis Theory (RAT)
  - Vaa's Risk Monitor Model (RMM)

Driver Behavioral Models

- Change of key concepts, conceptions and theories
- The three analysed models:
  - Shared basis in neuroscience, i.e. adopting Damasio's paradigm
  - Have been further developed for being well suited to state hypotheses to be tested in contexts associated with AV

Summala's Multiple Comfort Zone

- Incorporates factors influencing safety margins
- TTC, time to lane crossing, speed level and time headway, within an acceptable range → satisfaction, comfort
- Comfort zone enables drivers to react properly

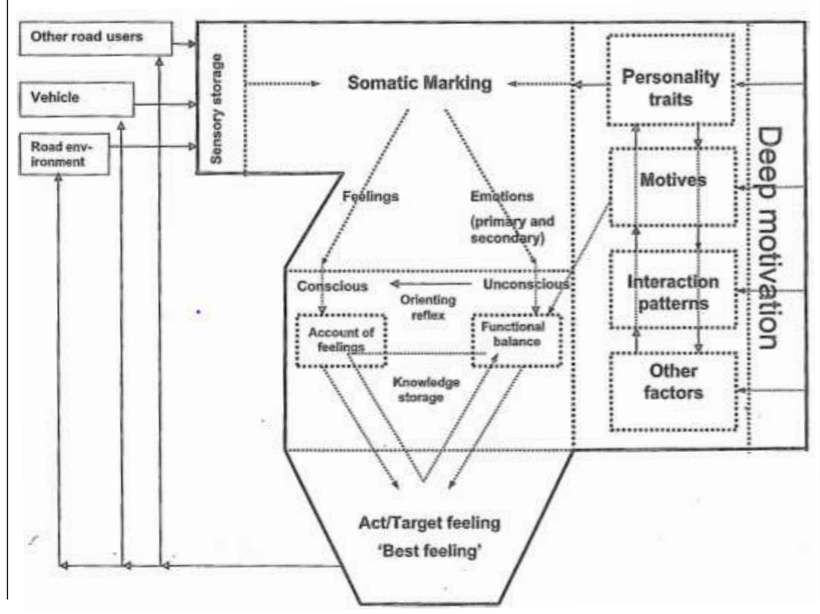
Factors influencing driving behavior and comfort zone boundaries	
sufficient space	road system
sufficient time	roadway complexity
vehicle characteristics	driver experience
speed limits	driver's response style

Fuller's Risk Allostasis Model (RAT)

- Feeling of risk within the preferred range.
- This feeling defines, controls and influences driving behaviour
- Driver behaviour changes for maintaining the feeling of risk within the range
- Speed choice and time or distance headways adjustment for feeling of risk maintenance

Factors influencing feeling of risk	
driver's motivation	environment
driver capabilities	road environment
human factors	vehicle characteristics

Vaa's Risk Monitor Model (RMM)



Challenges

- Lack of relevant data for understanding AV behavior under various traffic and weather conditions is critical
- Ensure safety of drivers and other road users under autonomous mode
  - Technology
  - Hacking risks
- "Human vs machine" → public acceptance and technology adoption
- Should the humans be adapted to the machine behavior or the machine to the different driving behaviors?

Conclusions

- AV behavioral model determines public acceptance and adoption
- AVs should have increased levels of safety, security and comfort
- AVs should be able to adopt in different (non) emergency and extreme conditions
- Definition of parameters → Extension of behavioral models for including autonomous operation

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More information

Foteini Orfanou
forfanou@central.ntua.gr