

Key requirements and a method for measuring in-vehicle user interfaces' distraction potential

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THE 8TH INTERNATIONAL CONFERENCE ON DRIVER DISTRACTION AND INATTENTION (DDI'22)

Gothenburg, 20.10.2022



Overview

- **1.** Key requirements for measuring in-vehicle user interfaces' distraction potential (10)
- 2. A possible assessment method that fulfills the requirements







Key requirements for measuring in-vehicle user interfaces' distraction potential – based on research

- 1. Inattention should be evaluated against attentive task performance.
- 2. Inattention should be assessed against the spare attentional capacity available in attentive driving.
- 3. Situational variabilities in the spare attentional capacity should be recognized.
- 4. Inter-individual differences in the spare attentional capacity should be controlled for.
- 5. Drivers' cognitive processing abilities and limitations should be acknowledged.
- 6. Evaluation should focus on cognitive processes that are relevant for attentive driving.
- 7. Evaluations should be probabilistic to avoid hindsight bias.
- 8. There should be a link to real-life crash risk or to a real-life performance failure probability.
- 9. Possibility should be more important than probability.

10. The assessment should be based on the worst-case scenario.



1. Inattention should be evaluated against attentive task performance.

WHY?

- For measurement validity
- Definition of driver inattention (Regan et al. 2011): "insufficient, or no attention, to activities critical for safe driving"



Driver distraction and driver inattention: Definition, relationship and taxonomy

Michael A. Regan^{a,*}, Charlene Hallett^a, Craig P. Gordon^b

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2. Inattention should be assessed against the spare attentional capacity available in attentive driving.

A Review of Occlusion as a Tool to Assess Attentional Demand in Driving

Tuomo Kujala[®], University of Jyväskylä, Finland, Katja Kircher[®], and Christer Ahlström[®], Swedish National Road and Transport Research Institute, Linköping, Sweden

WHY?

- The myth of 100% attention
- ...but there is often spare attentional capacity in attentive driving.
- Task-critical threshold(s) define the spare capacity

frontiers in Neuroergonomics

PERSPECTIVE published: 28 September 2021 doi: 10.3389/fnrgo.2021.718699

> Check for updates

Inattention and Uncertainty in the Predictive Brain

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3. Situational variabilities in the spare attentional capacity should be recognized.

WHY?

- For validity and reliability
- Because there are situational variabilities in spare attentional capacity in driving.

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Tuomo Kujala, University of Jyväskylä, Finland, **Katja Kircher**, and **Christer Ahlström**, Swedish National Road and Transport Research Institute, Linköping, Sweden



4. Inter-individual differences in the spare attentional capacity should be controlled for.



Individual glance strategies and their effect on the NHTSA visual manual distraction test

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WHY?

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- For reliability
 - Because there are inter-individual differences in the spare attentional capacity.
 - Balancing of participant samples
 - Individual baselines of attentive driving

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5. Drivers' cognitive processing abilities and limitations should be acknowledged.

frontiers in Neuroergonomics

PERSPECTIVE published: 08 December 2021 doi: 10.3389/fnrgo.2021.778043

Eye Tracking in Driver Attention Research—How Gaze Data Interpretations Influence What We Learn

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WHY?

- For external validity (and to be fair)
- E.g., focal vs. peripheral vision in lateral and longitudinal control tasks



Effects of cognitive load on response time in an unexpected lead vehicle braking scenario and the detection response task (DRT)

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Detection and response to critical lead vehicle deceleration events with peripheral vision: Glance response times are independent of visual eccentricity

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Transportation Research Part F 59 (2018) 463-474 Contents lists available at ScienceDirect

Transportation Research Part F

journal homepage: www.elsevier.com/locate/trf

Effects of cognitive load on response time in an unexpected lead vehicle braking scenario and the detection response task (DRT)

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Does it deliver what it promises? Evaluation of cognitive distraction caused by speech-based interfaces with detection response and box task

Alexandra Loew^a, Yannick Forster^{b,*}, Frederik Naujoks^b, Bianca Biebl^a, Andreas Keinath^b, Klaus Bengler^a

6. Evaluation should focus on cognitive processes that are relevant for attentive driving.

WHY?

 For external validity and ecological relevance

ISO 17488:2016

Road vehicles — Transport information and control systems — Detertionresponse task (DRT) for assessing attentional effects of cognitive load in driving

ISO 16673:2007

Road vehicles — Ergonomic aspects of transport information and control systems — Occlusion method to assess visual demand due to the use of in-vehicle systems DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

Docket No. NHTSA-2010-0053

Visual-Manual NHTSA Driver Distraction Guidelines

For In-Vehicle Electronic Devices



7. Evaluations should be probabilistic to avoid hindsight bias.

Minimum Required Attention: A Human-Centered Approach to Driver Inattention

Katja Kircher and Christer Ahlstrom, The Swedish National Road and Transport Research Institute (VTI), Linköping, Sweden

WHY?

- Hindsight bias
- We should know already before a crash or a performance failure, if a driver is inattentive/distracted.



Driver distraction and driver inattention: Definition, relationship and taxonomy Michael A. Regan^{a,*}, Charlene Hallett^a, Craig P. Gordon^b

^a French Institute of Science and Technology for Transport, Development and Networks (IFSTTAR), Lyon, France ^b Alcohol Advisory Council of New Zealand, Auckland, New Zealand



8. There should be a link to real-life crash risk – or to a real-life performance failure probability.

WHY?

For ecological relevance

IET Intelligent Transport Systems



Research Article

Holistic assessment of driver assistance systems: how can systems be assessed with respect to how they impact glance behaviour and collision avoidance?

ISSN 1751-956X Received on 15th November 2018 Revised 24th June 2019 Accepted on 12th July 2019 E-First on 5th August 2019 doi: 10.1049/iet-its.2018.5550 www.ietdl.org

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9. Possibility should be more important than probability.

Contents lists available at ScienceDirect
Accident Analysis and Prevention
journal homepage: www.elsevier.com/locate/aap

Accident Analysis and Prevention 146 (2020) 10571

Expert Drivers' Prospective Thinking-Aloud to Enhance Automated Driving Technologies – Investigating Uncertainty and Anticipation in Traffic Hilkka Grahn^{*}, Tuomo Kujala, Johanna Silvennoinen, Aino Leppänen, Pertti Saariluoma University of Jyrakiyla, P.O. Box 35, 17-40014, Finland

WHY?

- Effects on latent hazard perception/prediction ability
- Because attentive driving is about keeping risk at 0/minimum by adapting behavior to the variable situational possibilities ("What if?").

Original Articles

Risk control is not risk adjustment: the zero-risk theory of driver behaviour and its implications

 HEIKKI SUMMALA

 Pages 491-506 | Received 13 Apr 1987, Published online: 30 May 2007

 Source Download citation

 Phttps://doi.org/10.1080/00140138808966694



10. The assessment should be based on the worst-case scenario.

WHY?

 Again, because possibility should be more important than probability in safety assessments.



A possible assessment method that fulfills the requirements





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The research was partly funded by Academy of Finland (Appropriate Uncertainty in Manual and Automated Driving/343259).