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Relating Experimental Drive Distraction and Driving Performance
Metrics to Crash Involvement - Definitions of Terms and Concepts

RATIONALE

Driver distraction is one of the key factors underlying road crashes (refer to Ascone et al. 2009; NHTSA 2009, 2017) and thus is a major focus for policymaking and human-vehicle interface design. There are many existing metrics and procedures for the experimental evaluation of driver distraction, several of which have been specified in international standards and/or regional guidelines (e.g., ISO 15007-1, ISO/TS 15007-2, ISO 16673, ISO 26022, ISO 17488, and SAE J2944). However, it cannot be simply assumed that the effects of distraction on driving performance or driver behavior/state measured with these procedures are directly indicative of real-world crash involvement. Thus, there is a need for approaches that can be used to systematically relate experimentally measured effects of driver distraction on driving performance and driver behavior/state to real-world crash involvement. This document provides a set of concepts and definitions of terms that can be used to characterize this relation.

1. SCOPE

This Information Report provides functional definitions and discussions of key terms and concepts for relating the experimental evaluation of driver distraction to real-world crash involvement. Examples of driver distraction and driving performance metrics include those related to vehicle control, object and event detection and response (OEDR), physiological indicators, subjective assessments, or combinations thereof. Examples of real-world crash involvement metrics include the epidemiological effect size measures of risk ratio, rate ratio, and odds ratio. The terms and concepts defined in this document are not intended to contribute to methodologies for assessing the individual metrics within a domain; these are covered in other SAE documents (e.g., SAE J2944) and SAE technical reports. For any measure chosen in one domain or the other, the goal is to give general definitions of key terms and concepts that relate metrics in one domain to those in the other. Issues of repeatability and validity are discussed in relation to these methods and metrics for relating the two domains. However, the actual specification of a particular methodology for predicting crash involvement from experimental studies is outside the scope of the present document.

This informational report applies to all motorized on-road road vehicles including passenger cars, trucks, buses, and powered two-wheelers. Driver distraction may be related to any activity that competes with the driving task and diverts attention away from activities critical for safe driving.

Note that the terms and concepts described herein may also be general enough to suggest methods to estimate crash involvement of real-world automated vehicles from simulation metrics. The intended users of the document are practitioners and researchers in the industry, academia, and other organizations with interest in driver distraction and driving performance assessment and road safety.

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2. REFERENCES

2.1 Applicable Documents

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3. DEFINITIONS

3.1 CRASH

An unstabilized situation which includes at least one harmful event (refer to ANSI, 2017).

3.2 CRASH-PRODUCING MECHANISM

The set of factors or circumstances giving rise to a crash.

3.3 CRASH RISK

The probability of a crash.

NOTE 1: This definition may also be applied to other types of safety-critical events such as near crashes or crash-relevant conflicts. For example, near-crash risk can be similarly defined as the probability of a near crash.

NOTE 2: Crash risk refers to absolute crash risk, which does not need a denominator. A denominator is only needed for risk ratios, rate ratios, or odds ratios (see Appendix A).

3.4 DRIVER ACTIVITY

Any actions performed by the driver while in the vehicle.

NOTE: Driver activities may include driving-related actions such as steering, braking, changing lane, and navigating, as well as non-driving related activities such as conversation with a passenger, eating, etc. Activities also include covert actions such as thinking and daydreaming, but excludes driver states such as fatigue, substance-induced impairments, etc.

EXAMPLE: Driver activities may or may not be goal directed. Goal-directed activities are defined here as behaviors.

3.5 DRIVER BEHAVIOR

Engagement in the primary (driving) task or a secondary task to reach or maintain a goal state.

NOTE: Driver behavior is a subset of driver activity and refers to what the driver is doing.

EXAMPLE: Keeping the vehicle in the lane.

3.6 DRIVING PERFORMANCE

The collective result of the driver, vehicle, and the road environment acting together measured relative to some standard or reference.

NOTE: Driving performance reflects the quality of driver-vehicle-road interactions.

EXAMPLE: The mean lateral distance relative to the center of the lane.

3.7 DRIVER DISTRACTION

The diversion of attention away from activities critical for safe driving toward a competing activity, which may result in insufficient attention or no attention to activities critical for safe driving. (Refer to Regan et al.; 2011, p. 1776.)

NOTE: Regan et al. (2011, p. 1776) use the term “driver-diverted attention” but note that “[T]his category of inattention is synonymous with ‘driver distraction.’ ” For detailed definitions of the individual terms in this high-level definition, refer to Foley et al. (2013).

3.8 DRIVER STATE

A set of conditions internal to the driver that affects how the driver is able to perform the driving task.

NOTE: Examples include primarily cognitive states (e.g., expectancy, attentiveness, willingness to engage in a task), as well as physical states (fatigue, drowsiness, substance-induced impairments). However, the cognitive/physical distinction is not sharp unless the metrics are orthogonalized (e.g., Young et al., 2016). Otherwise, driver states may involve aspects related to both physical and cognitive state.