How humans perceive the severity of traffic events?

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The SAE standard on Surrogate Measures of Safety (SMoS) defines them as ‘indicator(s) derived from observation and safety gradation of non-crash events in traffic with the ultimate goal to estimate the expected crash/injury frequency as well as to get a better understanding of the crash mechanisms and contributing factors’ (SAE, 2019).

This work focuses on the phenomenon of ‘safety gradation of non-collision events’. The earlier theoretical work suggested that a proper severity measure for an event should reflect the risk of a personal injury, which is often split into two components - the risk of a collision and its potential consequences had the collision taken place (Laureshyn et al., 2017). While there is a great number of severity measures suggested, most of them fail to address both components accordingly (Johnsson et al., 2018; Mahmud et al., 2017), resulting in counter-intuitive event gradations and inconclusive outcomes when validation studies are attempted.

On the other hands, it has been shown that human observers (experts as well as non-experts in traffic) are often in very good agreement when given a task to rank traffic situations by their severity or dangerousness (Madsen, 2018; Kruysse, 1991; Grayson, 1984). It appears that humans have a relatively well-calibrated ‘internal mechanism’ to judge risks in traffic, at least in the role of a side observer. While there is no direct proof that the human judgements are indeed the ‘true severity measure’, they are clearly more comprehensive and closer to the theoretical severity concept. Some validation studies also indicate that human judgements outperform the simplistic objective measures in estimation of accident risks (Svensson, 1992).

This study presents a methodological approach to better understanding which objective factors and parameters describe human judgements of traffic event severity. A set of video-recorded traffic situations, varying from normal encounters to traffic conflicts and actual collisions is used. Instead of directly asking observers for severity scores, we present the situations pairwise and ask to select the most severe one (a modification of ‘random walking’ method used in environmental psychology, Patching et al., 2017). With sufficient amount of processed pairs, the situations can be ranked along the severity dimension and clusters of ‘same severity’-situations can be identified and controlled for.

On the objective side, each situation is described with a set of indicators such as road users’ positions over time, speeds, approach angle, Time-to-Collision, kinetic energy, Delta-V, etc. A factorial analysis is performed to estimate which of the objective variables contribute the most to the subjective severity perception.

The expected outcome of this work is recommendations for a more universal objective measures (or scores, i.e. combinations of several measures) that are: i) ‘make sense’, i.e. are not counter-intuitive; ii) versatile, i.e. take into account several factors and weigh them in according to their importance. We acknowledge that ‘yet another’ new severity measure will still require proper validation of its performance in estimation of expected accident level. This, however, will be another study and another NTSA presentation in the future.
References
Svensson, Å. (1992) 'Vidareutveckling och validering av den svenska konflikttekniken' (in Swedish) 'Further development and validation of the Swedish traffic conflict technique'. Lund University, Institute of Technology, Dept. of Traffic Planning & Engineering.