

## How humans perceive the severity of traffic events involving cyclists?

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**Keywords:** surrogate measures of safety, traffic conflict, severity indicator, danger perception

Surrogate Measures of Safety (SMoS) are often advocated as an alternative or complement to safety analysis based entirely on the historical accident records. The SAE standard on 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'.

This study focuses on the part of this definition related to the 'safety gradation of non-crash events'. The theory suggests that a proper measure of severity for an event should reflect the risk of a personal injury, which in its turn can be split into two components - the risk of a collision as such and its potential consequences had the collision taken place. While there is a great number of severity measures suggested (Time-to-Collision, Post-Encroachment Time, Delta-V, etc.), most of them fail to address both components accordingly, resulting in counter-intuitive event gradations at a closer look as well as inconclusive outcomes when validation studies are attempted. This is particularly noticeable in case of situations involving vulnerable road users, cyclists in particular.

On the other hand, 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. 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 when used to estimate the accident risks with SMoS methodology.

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 involving cyclists and motor vehicles, varying from normal encounters to traffic conflicts and actual collisions is used. The situations were presented pairwise to observers whose task was to select the one most severe. With a 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 objective indicators such as road users' positions over time, speeds, approach angle, Time-to-Collision, kinetic energy, Delta-V, etc. Binomial logistic regression was used to assess the association of human feelings of dangerousness with objective features.

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 together 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.