

Crash risk and subjective risk perception during urban cycling: Accounting for cycling volume

Rul von Stülpnagel, Cheyenne Petinaud and Sven Lißner

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Background:

In order to make cycling safer, most research has focused on the factors increasing the crash risk of cyclists. However, next to the crash probability (i.e., an indicator of the objective risk), there has been a growing interest in the perceived level of this risk (i.e. the subjective safety of cyclists). Subjective risk perception is important to consider, as it may influence people's propensity to use their bike. Crowdsourcing platforms can provide unprecedented insights into this matter. So far, our understanding of the relation between subjective risk perception and objective risk during urban cycling (as well as their sources) remains limited. Crash risk and subjective risk perception appear to be mostly well aligned. For example, reduced speed limits have been found to reduce both objective and subjective risks. (However, there is also evidence for some incongruences.)

An additional challenge of investigating crash statistics and crowd-sourced data on cycling risks is imposed by the frequently unknown cycling volume, leading to emphasis on locations where a high base rate of cyclists can report about their experiences, or be involved in crashes. This effect may bias the interpretation of which urban areas are particularly safe or dangerous, respectively.

Aim:

We investigate the relation of cycling crashes and subjective risk perception (operationalized through reports from a crowd-sourcing project) for different types of cycling infrastructure and different speed limits, while accounting for the local cycling volume.

Method:

We present an investigation of objective and subjective cycling risks in a large German city. About 5,000 crowdsourced contributions on cycling risks as well as about 17,000 confirmations of existing contributions, collected by a German newspaper, are used as an indicator of subjective risk. These data are compared with statistics about 4-5,000 crashes as an indicator of objective risk. Using GIS methods, we link these data to the underlying network of streets, with a particular focus on the respective speed limit and cycling infrastructure. We qualify the absolute numbers of crashes and subjective risk reports for each street segment with the cycling volume provided by the MOVEBIS project (see <https://www.movebis.org/das-projekt/>).

Results obtained or expected:

As hypothesized, we find that the absolute number of VGI reports and crashes can be misleading: whereas the absolute incident numbers, for example, suggest few benefits of cycling lanes and tracks, adjusting for the cycling volume reveals an increase of both objective and subjective safety as compared to streets without cycling infrastructure.

Concerning speed limits, we found that reducing the speed limit to 30 km/h reduced both objective and subjective risks for cyclists. However, a speed limit of 5-25 km/h provided no visible safety benefits over a speed limit of 50 km/h. Potential explanations could be that these streets are frequently designated as living streets, which are rather narrow as well as occupied by parking cars.

We also identify situations where cyclists apparently underestimate the crash risk (i.e. on cycleways opposing the cars' traveling direction, and at streets with a speed limit of 30 km/h intersecting streets with higher speed limits).

Conclusions

This research proves that analyzing a discrete number of incidents (such as crashes or subjective risk reports) may lead to misinterpretations, if the base rate of cyclists is neglected. Our main findings concerning the effects of cycling infrastructure and speed limits on cycling safety are in line with previous research. Although the indicators of objective and subjective risks are mostly well aligned, there are specific scenarios where cyclists underestimate the actual crash risk.