

User Centred Development of a Cyclists Warning System: Who should be warned and how?

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As vulnerable road users, cyclists have an increased risk of sustaining severe injuries when involved in an accident. Often, obstructed views and a lack of attention account for accidents or safety critical events (SCE) including cyclists. In turn, negative cycling experiences and/or a poor sense of security when participating in road traffic may deter from using the bicycle as a climate-neutral means of transport. To address these issues, the German research project 'RADimFOKUS' (translation: BIKEinFOCUS) aims at developing a collision warning system that detects potential SCEs using connected traffic data. This utilisation of real-time information from connected traffic offers the potential of an early hazard detection, directing the attention of involved road users to hazards and thus, avoiding accidents or SCEs. Thereby, 'RADimFOKUS' takes into account and symbiotically combines the overall aims of reducing CO₂-emissions and increasing traffic safety by making bicycle traffic safer and more attractive. As a first step, the following potentially critical situations with specific relevance for cyclists were prioritized for the project: a) right turning truck with cyclist in blind spot, b) intersection with obstructed view, c) cyclist passing parking vehicles (dooring). According to the user-centred design process (UCD), potential users should be involved already in early stages in the development process of new systems. Following the requirement specification (UCD: second stage), we conducted an online survey to investigate (1) which road user (cyclist and/or car driver) should receive a warning depending on the conflict situation and (2) what kind and modality of warning signal is preferred. In sum, 218 participants with a mean age of 34 years (SD = 13) and rather higher educational qualifications (university degree: 47%, completed vocational training: 15%) completed the survey. Based on their frequency of bicycle use, participants were divided into two groups in order to respond either from a cyclists' (bicycle use at least on 1-3 days a week, n = 141) or car drivers' (bicycle use less frequently than 3 days a week, n = 77) perspective. Results revealed similar response tendencies for both road user perspectives and critical situations. Warning recipient: In all situations, most of the participants stated that both, car/truck drivers and cyclists, should be warned mutually. At intersections with obstructed view, we found that warning cyclists exclusively was preferred more often than in the other situations. Warning modality: An alerting sound was preferred most, followed by visual (warning light on screen) and haptic warning (vibrating steering wheel/ handlebars). In sum, participants reported neutral to positive attitudes towards such a cyclists warning system. Whereas a pre-post comparison revealed no difference for participants' attitudes towards the acoustic and haptic warning, the visual warnings were appraised to be less useful after preferences towards warning recipients and warning modality had been stated. This finding may indicate that, compared to acoustic and haptic warnings, visual warnings should be applied sparingly. However, empirical validation is required as this finding might be confounded by the online-survey condition in which it was aimed at assessing attitudes towards a future system and not the actual behaviour while using a real system. At the end of the online questionnaire, participants had the opportunity to address further remarks towards the cyclists warning system. In this context, some participants expressed concerns, e.g. regarding acoustic warnings as they might be missed hearing due to noisy surroundings. As also implemented by others, helmet-integrated speakers might be a remedy. Others acclaimed the system by stating that making use of technical capabilities is beneficial with respect to fostering thoughtful and cautious cooperation among road users. As an early developmental stage in UCD, requirement specification already provides an important basis for subsequent stages of this iterative process. Based on users' requirements concerning the cyclists warning system, rough drafts are prototyped. As soon as a prototypical system exists, more realistic studies enabling hands-on experience should be conducted from potential users' perspectives in order to complement survey data by behavioural measures and to assess the potential of such a system to increase cycling safety, cycling comfort and acceptance.

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